APPENDIX 'B'

PROGRAMME FORMS

A PROGRAMMED TEXT ON THERMOMETERS

LINEAR OVERT FORM

About this Programme :

On reading this programme, you will know many interesting things about thermometers. Thermometers are the instruments used to measure the heat levels. You have to know something about thermometers because we use them in hospitals, laboratories, houses and so on.

How to Read this Book :

(1) This book contains small steps called frames. Read each frame carefully.

(2) In some frames there will be a gap followed by two or more alternatives in the brackets. You have to select the suitable answer.

(3) In some frames there will be a gap or gaps. You have to fill in the gaps with suitable word or words.

(4) In some frames you have to tickmark the number of the correct answer or answers.

(5) You have to read each frame; think of the correct answer and then write it against the serial number on the separate answersheet given to you. If serial number of the answers are given to any question in the answer sheet you may put the tickmark _/ on the correct one and do not write the complete answer. Do not write anything in this book.

...2

(6) The correct answers are given in the same frame on the left hand side of the margin. Keep the answer covered with a card given to you.

(7) After writing your answers, move the card and check whether you are right or not.

(8) If your answer is correct, then go to the next frame. But if your answer is not correct, do not worry. Read the frame and try it again.

COVER the correct answers

READ the frame

UNDERSTAND it

WRITE the answer

CHECK your answer

PROCEED FURTHER

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1. A beaker filled with water is kept on fire.

(a) Yes — (a) Does the water get heated? _____ (Yes/No)

(b) rises — (b) Its heat level _____ (rises/falls).

---

2. A pot of water is kept in ice.

(a) cooled — (a) It gets _____ (heated/cooled).

(b) falls — (b) Its heat level _____ (rises/falls).

---

3. On heating, the heat level of water rises. On cooling, the heat level of water falls.

Can the heat level be changed by heating or cooling? _____ (Yes/No)

Yes

---

4. Ice water and boiling water differ in their heat levels. In other words, ice water and boiling water differ in their temperatures.

Does the temperature indicate the heat level of a substance? _____ (Yes/No)

Yes

---

5. (a) Temperature indicates the heat _____ of a substance.

(b) When the heat level is high, we say that the temperature is _____ (high/low).

(c) When the heat level is low, we say that the _____ is low.

(a) level
(b) high
(c) temperature

---

6. The heat level of a substance is scientifically known as the temperature of that substance. A substance at low temperature is said to be cold.

A substance at high temperature is said to be _____ (cold/hot).

hot

---

7. (a) If the temperature of a substance is _____ (high/low) we say that it is hot.

(a) high

(b) If the _____ of a substance is low, we say that it is cold.

(b) temperature

---

8. What are the common words used to indicate the following?

(a) cold

(a) Low temperature : _____

(b) hot

(b) High temperature : _____

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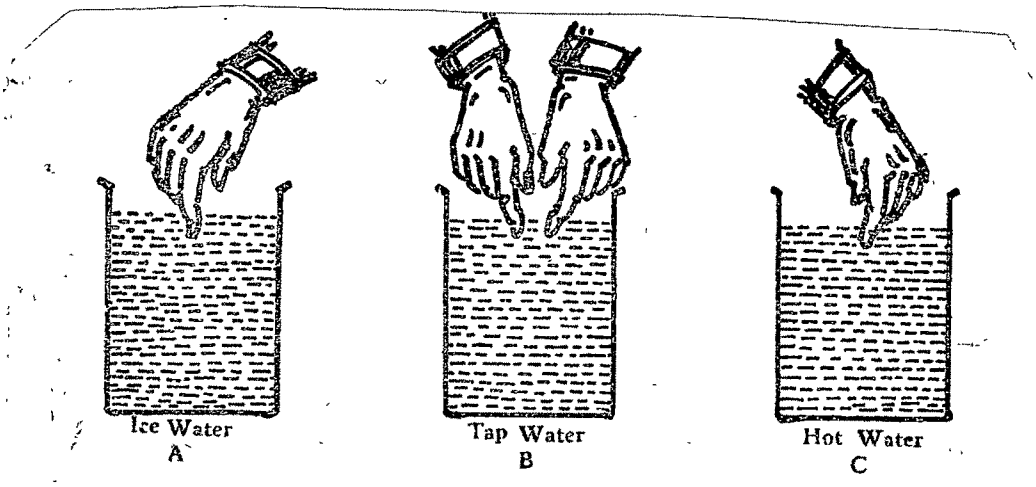
9. The following is one way of FEELING whether a substance is cold or hot.

Observe the figure carefully and answer the following :



(a) Ram dipped his right hand finger in the beaker A. It was felt _____(hot/cold).

(a) cold

(b) Ram dipped his left hand finger in the beaker C. It was felt _____(hot/cold).

(b) hot

---

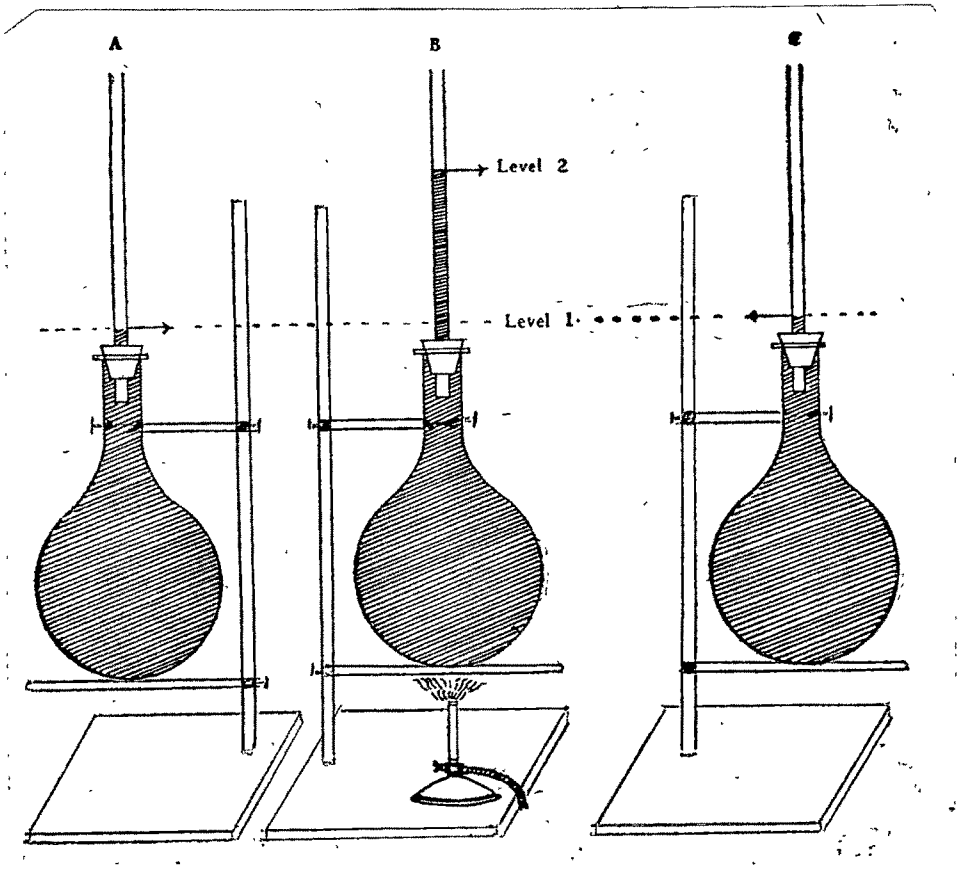
10. Then he dipped both the fingers in the beaker B. to the right hand, the water in the beaker B was felt hot and to the left hand it was felt cold.

Can the exact temperature of water be known by touching it? _____ (Yes/No)

No

(ii) _/	11.	Tickmark _/ the number of the correct answer. Ram's experience regarding the temperature of water in beaker B. (i) remained the same. ( ) (ii) differed from hand to hand. ( )
could not	12.	By touching the tap water, Ram _____ (could/could not) know its exact temperature.
temperature	13.	Heat level or temperature of a substance can be measured scientifically using a thermometer. The instrument used to measure the _____ of a substance is called thermometer.
thermometer	14.	To measure the temperature of a substance we use an instrument called _____.
Yes	15.	Can Ram know the exact temperature of water in beaker B by using a thermometer? _____(Yes/No)
(a) rises (b) falls	16.	(a) When a substance is heated, its temperature _____ (rises/falls). (b) When a substance is cooled, its temperature _____.
temperature	17.	On heating or cooling a substance, its _____ changes.

18. Observe the figure carefully and answer the following frames :



In figure A the flask is filled with water upto level 1.

The flask is heated with a burner as shown in the figure B.

Due to heating, the level of water _____ (rises/falls) from Level 1 to Level 2.

rises

---

19. Burner is removed and the flask is cooled.

On cooling, the level _____ (rises/falls) as shown in figure C.

falls

---

20. Tickmark _/ the number of the correct answer.

Rise in the level of water in figure B is due to

(a) cooling ( )

(b) adding some more water ( )

(c) heating ( )

(c) _/

---

falls	21. The level of milk rises when it is heated. But on cooling, its level _____(rises/falls).
more	22. When any liquid (milk or water) is heated, its level rises and it occupies _____ (more/less) space.
heating	23. Occupying more space on _____(heating/cooling) is called expansion.
less	24. When water is cooled, its level falls and it occupies _____ space.
contraction	25. Occupying less space on cooling is called _____ (expansion/contraction).
(iii) _/	26. Tickmark _/ the number of the correct answer. Expansion means (i) occupying more space on cooling ( ) (ii) occupying less space on cooling ( ) (iii) occupying more space on heating ( ) (iv) occupying less space on heating ( )
contracts	27. When the temperature of a substance falls, it _____ (contracts/expands).
(i) _/ (ii) _/ (iii) _/	28. Below are given some words related to expansion and contraction. Tickmark (_/) the number of only those related to contraction. (i) Cooling ( ) (ii) Fall in the temperatue ( ) (iii) Occupying less space ( ) (iv) Rise in the temperature ( ) (v) Occupying more space ( ) (vi) Heating ( )

29. The thermometer is constructed on the principle that liquids expand with _____ (rise/fall) in temperature and contract with fall in _____.

rise

temperature

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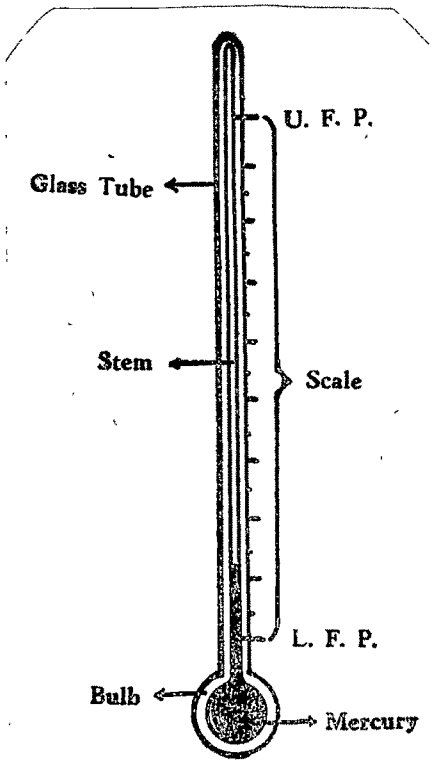
30. Below is given the figure of a thermometer. Study the figure carefully and recognize the various parts of it.



(a) The lower end of the thermometer which is filled with mercury is called the _____.

(b) Thermometer has a scale to measure the _____ of a substance.

(c) The scale is marked on the stem.

In the figure above, some divisions are marked on the stem of the thermometer. These divisions make a _____ which helps to measure temperature.

(a) bulb
(b) temperature
(c) scale

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31. (a) The thermometer is filled with _____.

Tickmark ✓ the number of the correct answer.

(b) Mercury is filled in the
(i) entire stem ( )
(ii) part of the stem ( )

(c) U.F.P. is at the _____ (lower/upper) end of the temperature scale.

(a) mercury
(b) (ii) ✓
(c) upper

32. U.F.P. is the upper fixed point of the scale.

The lower fixed point of the scale is marked as _____.

L.F.P.

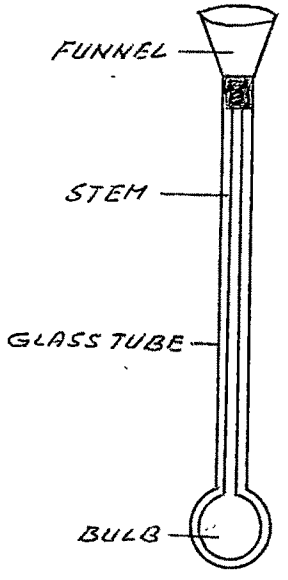
---

33. Thermometer is constructed on the principle of expansion and contraction of liquids.

Let us see the material used in the construction of the common thermometer.

Study the figure carefully and answer the following frames :

Fig - 1



A tube with narrow and uniform bore which is made up of _____ (glass/metal) is taken.

glass

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34. (a) The lower end of the glass tube is blown into a _____.

(b) The funnel is at the _____ (lower/upper) end of the tube.

(a) bulb
(b) upper

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35. The upper end is used to pour the _____ into the glass tube.

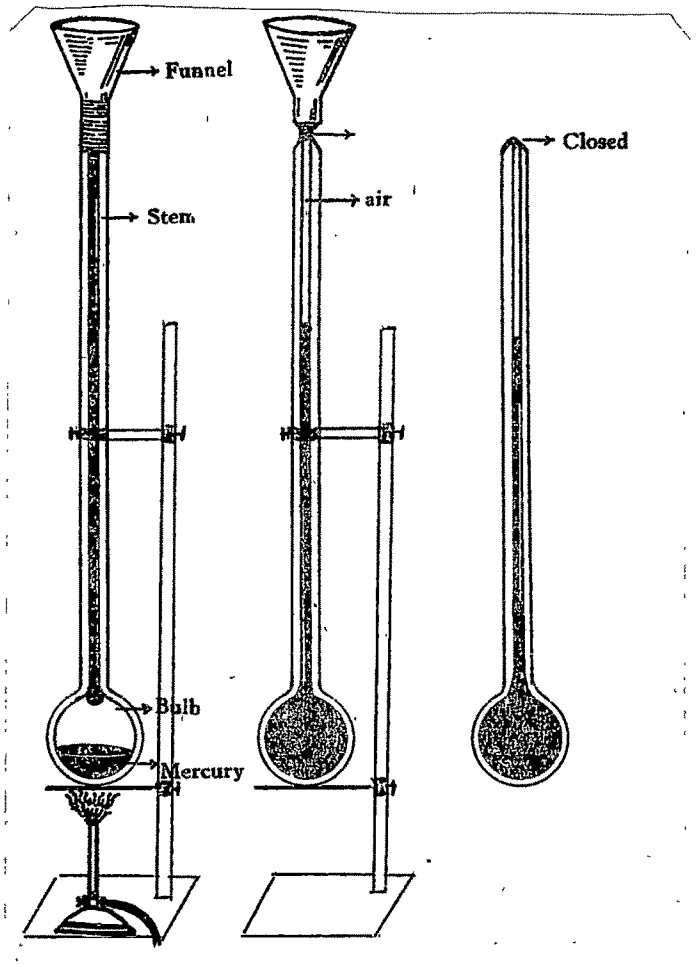
mercury

36. The upper end is in the shape of a _____ through which mercury can be poured.

funnel

37. The following frames describe the process of filling the bulb and the stem with mercury and sealing its upeer end.

Study the figures carefully and answer the following frames :



(a) The mercury is poured through the _____ (bulb/funnel).

(a) funnel

(b) After pouring some mercury, the bulb is _____ (heated/cooled) with the burner.

(b) heated

38. The glass tube contains air inside it. On heating, the mercury expands and drives the _____ out.

air

	39. Burner is removed and the glass tube is allowed to cool down. The mercury in the
cold	glass tube becomes _____ (hot/cold).
	40. Heating and cooling are repeated till the entire bulb and a part of the stem are filled with
mercury	_____.
	41. The mercury is heated in order to drive all the
air	_____ out.
	42. After driving all the air out, the upper end
closed	is _____ (closed/kept open).
	43. Tickmark _/ the number of correct answer.
	Mercury is strongly heated in order to
	(i) seal the thermometer ( )
	(ii) drive the air out ( )
(ii) _/	(iii) make the mercury expand ( )
	44. The air above the mercury level is driven out. Thus a vacuum is created. The vacuum is
above	_____ (above/below) the mercury level.
	45. After sealing the upper end, there is _____
vacuum	(air/vacuum) above the mercury level.
	46. After sealing the upper end, there is no air
mercury	(= vacuum) above the level of _____.
	47. There is _____ (air/vacuum) above the mercury
vacuum	level.

48. The mercury expands when there is a _____ (rise/fall) in temperature.

rise

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49. The thermometer would burst if there is no space for the _____ (mercury/air) to expand.

mercury

---

50. The thermometer would burst at higher temperatures if there is no _____ (air/mercury/vacuum).

vacuum

---

51. Vacuum allows the mercury to _____ (expand/contract).

---

52. The level of a shining liquid can be seen clearly through the glass. So shining liquids are highly suitable to be used in the thermometers.

Mercury is used in the thermometers because it is a _____ liquid.

shining

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53. Liquids which wet the glass do not show exact readings. Mercury shows the exact readings because it _____ (wets/does not wet) the glass.

does not wet

---

54. The liquid used in the thermometers should be a good conductor of heat (i.e. it should take up heat readily).

Mercury is used in the thermometers because it is a good _____ of heat.

---

55. Bad conductors do not take up heat readily.

Can we find out small changes in temperature using a bad conductor of heat (i.e. one which does not take up heat readily)? _____(Yes/No)

No

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56. Of the following, tickmark ✓ the number of those statements which describe why mercury is used in the thermometers :

(a) Mercury cannot be seen through the glass. ( )
(b) Mercury is sensitive to even small changes in temperature. ( )
(c) Mercury does not wet the glass. ( )
(d) Mercury expands and contracts very slowly. ( )
(e) Mercury can be seen through the glass. ( )
(f) Mercury is a shining solid. ( )
(g) Mercury is a shining liquid. ( )
(h) Mercury sticks to the glass. ( )

(b) ✓
(c) ✓
(e) ✓
(g) ✓

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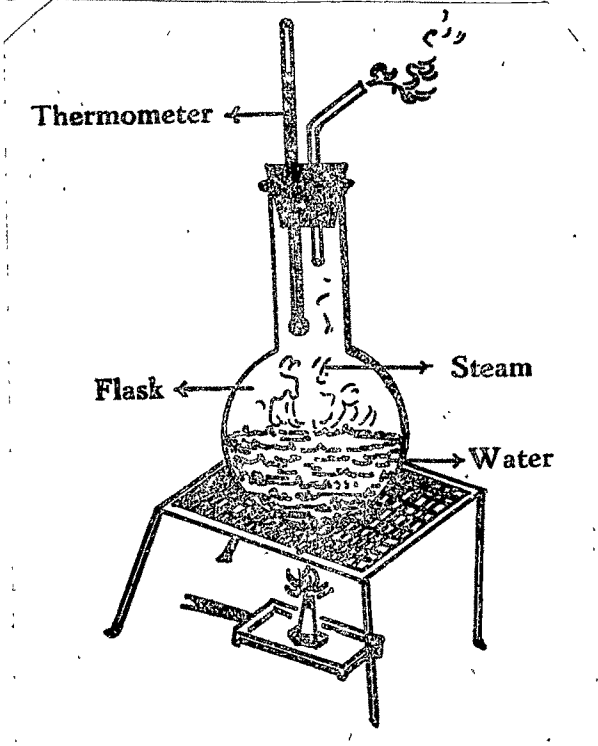
57. On the stem of the thermometer are marked the two important points of the temperature scale, namely, the U.F.P. and the L.F.P.

In the following frames the procedure of marking the U.F.P. is described.

Observe the figure carefully and answer the following frames :



MARKING THE U. F. P.

(a) The thermometer is kept _____ (above/below) the level of boiling water.
(b) Due to the high temperature of boiling water, the mercury level in the thermometer _____ (rises/falls).

(a) above
(b) rises

---

58. (a) After reaching a point (at the boiling point of water), the level of _____ in the thermometer does not rise further.

(a) mercury
(b) upper

(b) This point is marked as the _____ (upper/lower) fixed point.

---

59. The temperature at which water boils and turns into steam is called the boiling point of _____ (water/mercury).

water

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60. The mercury remains steady at the _____ point of water.

boiling

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61. Upper fixed point (U.F.P.) of the temperature scale is marked at that point where the mercury level is _____ (steady/rising).

steady

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62. The boiling point of water at which the mercury level is steady is marked as the _____ _____ _____ or _____ of the scale.

Upper Fixed Point or U.F.P.

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63. Does the U.F.P. indicate the boiling point of water? _____ (Yes/No)

Yes

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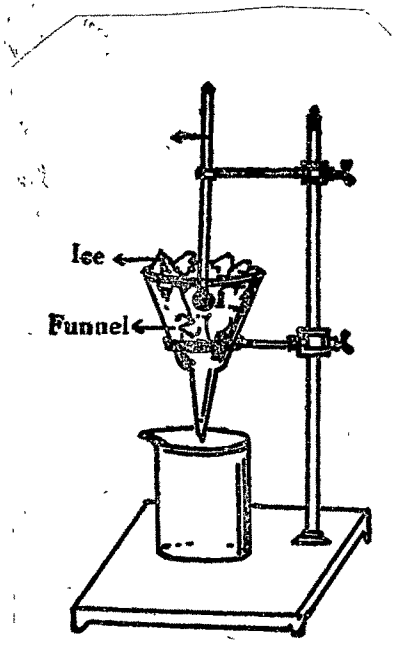
64. We have seen that the U.F.P. is marked at the boiling point of water. In the following frames the process of marking the Lower Fixed Point (L.F.P.) of the temperature scale is described.

Observe the figure carefully and answer the following frames :



MARKING THE L. F. P.

Bulb of the thermometer is put in a funnel filled with melting _____.

ice

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65. Due to the low temperature of melting ice, the level of the mercury _____ (falls/rises).

falls

---

66. (a) After reaching a point (at the melting point of ice) the level of _____ does not fall further.

(b) This point is marked as the _____ (upper/lower) fixed point.

(a) Mercury
(b) lower

67. The temperature at which ice melts is called the melting point of _____ (ice/water/mercury).

ice

---

68. Mercury remains steady at the _____ point of ice.

melting

---

69. Lower Fixed Point (L.F.P.) is marked at the point where mercury level is _____ (steady/falling).

steady

---

70. The mercury level remains steady at the melting point of ice. This is marked as the _____ _____ _____ or _____ of the scale.

Lower Fixed Point, L.F.P.

---

71. Tickmark _/ the number of correct answer.

U.F.P. indicates the

(i) melting point of ice ( )

(ii) _/ (ii) boiling point of water ( )

---

72. Tickmark _/ the number of correct answer.

The fixed point marked at the melting point of the ice is the -

(i) L.F.P. ( )

(i) _/ (ii) U.F.P. ( )

---

73. There are many divisions between the L.F.P. and U.F.P. These divisions are marked with numbers. The process of marking the divisions and numbers between the U.F.P. and _____ is called graduating the thermometer.

L.F.P.

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74. Marking the divisions and numbers of the temperature scale is called _____ the thermometer.

graduating

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75. Graduating the thermometer is the process of marking the _____ and _____ of the temperature scale (any order).

divisions
numbers

---

76. The divisions and numbers are made after making the _____ and _____ fixed points. (any order)

upper
lower

---

77. By marking the divisions and numbers, we get the _____ (U.F.P. and L.F.P./ temperature scale).

temperature scale

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78. After graduating (marking the divisions and numbers) we get either the Centigrade (C) scale or Fahrenheit (F) scale of temperature. C and F scales differ in 3 ways :

(i) the value of L.F.P.

(ii) the value of U.F.P.

(iii) the number of divisions between U.F.P. and L.F.P.

Do C and F scales contain the same number of divisions between U.F.P. and L.F.P.?

No _____(Yes/No)

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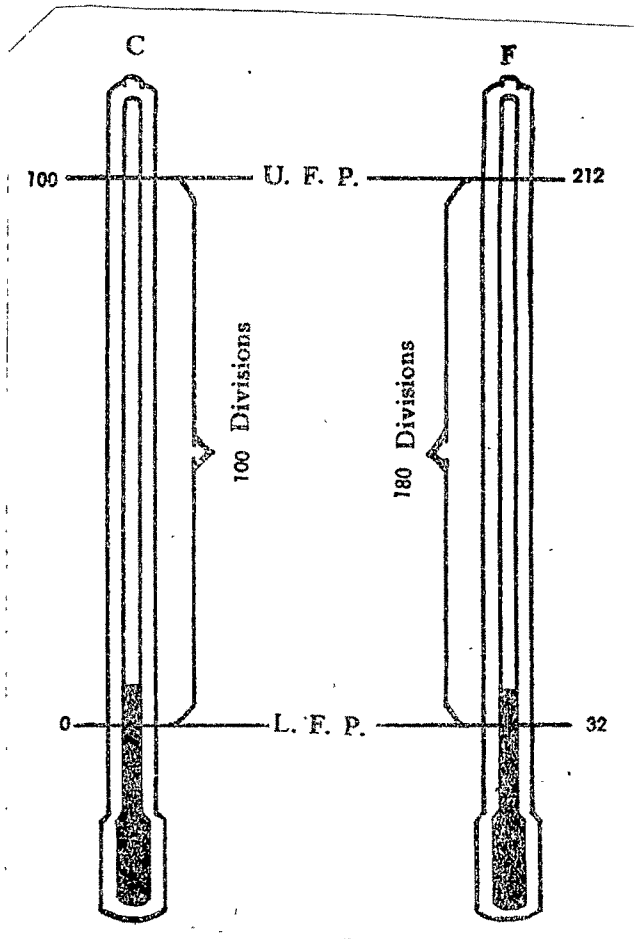
79. Now we shall study the differences between the C and F scales.

Observe the figure carefully and answer the following frames :



U.F.P.

(a) 100
(b) 212

(a) U.F.P. marked on the C scale is ____°C.
(b) U.F.P. marked on the F scale is ____°F.

---

80. L.F.P.

(a) 0°C
(b) 32°F

(a) L.F.P. marked on the C scale is _____.
(b) L.F.P. marked on the F scale is _____.

---

81. Number of divisions between the U.F.P. and L.F.P.

(a) 100
(b) 180
(c) F

(a) How many divisions are there in a C scale?

_____.

(b) How many divisions are there in a F scale?

_____.

(c) 32°F is the L.F.P. of _____ (C/F) scale.

---

82. 32°F is marked at the _____ (U.F.P./L.F.P.) of the F scale.

L.F.P.

---

83. Using a Centigrade scale, can we measure temperature very much higher than 100°C?

No _____ (Yes/No)

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84. What do the following abbreviations and symbols stand for?

(i)	Lower Fixed Point	(i)	L.F.P.	: _____
(ii)	Degree	(ii)	°	: _____
(iii)	Degree Centigrade	(iii)	°C	: _____
(iv)	Upper Fixed Point	(iv)	U.F.P.	: _____
(v)	Fahrenheit	(v)	F	: _____
(vi)	Centigrade	(vi)	C	: _____

---

85. Compare the Centigrade and Fahrenheit scales.

		Centigrade	Fahrenheit
(a) 100°C, 212°F	(a) U.F.P. is	_____	_____
(b) 0°C, 32°F	(b) L.F.P. is	_____	_____
(c) 100, 180	(c) No. of divisions are	_____	_____

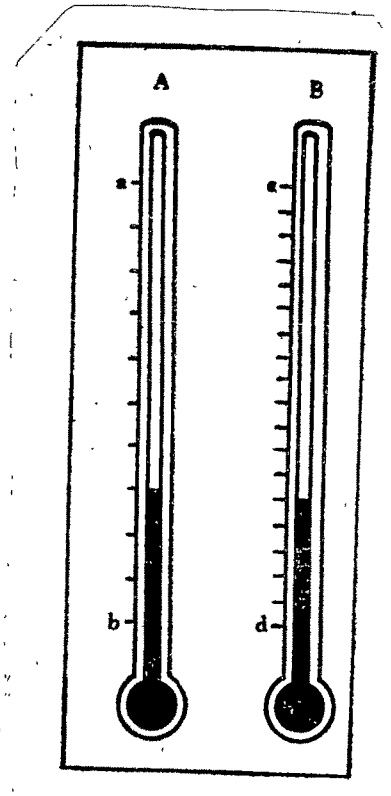
---

86. Observe the figure carefully.

The parts of the two thermometers with their U.F.P. and L.F.P. are shown. You have to write the values of those points in the blanks given below.

Figure A shows the scale that contains 100 divisions.

Figure B shows the scale that contains 180 divisions.



Fill in the blanks :

A. (1) The figure 'A' shows the _____ (Centigrade/Fahrenheit).
(2) The figure 'B' shows the _____ (Centigrade/Fahrenheit).

A. (1) Centigrade
(2) Fahrenheit

B. (1) Value at 'a' is _____ (100°C/212°F).
(2) Value at 'b' is _____ (0°C/ 32°F).
(3) Value at 'c' is _____. " "
(4) Value at 'd' is _____.

B. (1) 100°C
(2) 0°C
(3) 212°F
(4) 32°F

---

87. Temperatures are written as 23°C, 71°F, 4.8°C, 5.6°F etc. " " "

Two decimal eight degrees Fahrenheit is written as _____ (2.8°F/2.8°C).

2.8°F

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88. Twentytwo degrees Centigrade is written as _____ (22°C/22°F).

22°C

---

89. 61°C is the temperature which is 61 degrees above the zero degree of _____ (Fahrenheit/Centigrade).

Centigrade

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90. If the temperature is expressed in Fahrenheit scale, the symbol _____ (C/F) is to be used.

F

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91. Temperature below the 0° are expressed with a minus sign.

-61°C is a temperature which is _____ (above/below) the 0°C.

below

---

92. -47°F is a temperature which is 47 degrees _____ (above/below) the 0°F.

below

---

93. 17 degrees below the 0°C is written as _____ (17°C/-17°C).

-17°C

---

94. -38°F is a temperature, 38 degrees below the _____ (0°C/0°F).

0°F

---

95. Tickmark _/ the number of the correct answer.

-23°F is a temperature which is

(1) above the 0°F ( )
(2) below the 0°F ( )
(3) below the 0°C ( )

(2) _/

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96. (a) To find the temperature of hot water, the bulb of the thermometer is immersed in hot _____.

(b) Due to the high temperature of hot water, there is a _____ (rise/fall) in the mercury level.

(c) The main scale divisions to which the level of _____ rises is noted.

(a) water
(b) rise
(c) mercury
(d) temperature

(d) The number marked on that particular division where mercury level remains steady gives the _____ of the hot water.

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97. The temperature of water at 50°C is more than the temperature of water at _____ (60°C/40°C).

40°C

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98. The bulb of a thermometer is first kept in water at 50°C. Then it is kept in water at 45°C. The level of mercury at 50°C is comparatively _____ (higher/lower) than that at 45°C.

higher

---

99. When the mercury level is higher, we can say that the temperature is comparatively _____ (high/low).

high

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100. Below are given the steps followed in using a thermometer. But it is not given in the proper order. Write the number of the correct order of the steps in the brackets :

1. Final recording of temperature e.g.51°C ( )
2. Mercury level of thermometer changes. ( )
3. Bulb of the thermometer is put in the liquid. ( )
4. Main scale division near the mercury level is noted. ( )

(3)
(2)
(4)
(1)

---

101. Common thermometers are used to measure the temperature of a substance. To measure the atmospheric temperature of a day, that is, the maximum and minimum temperatures of a day, or the body temperature of a patient, we need some special thermometers.

The minimum temperature of a day can be measured using a _____ (common/special) thermometer.

special

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102. Thermometers which record the atmospheric temperatures of a day are :

(i) Maximum thermometer
(ii) Minimum thermometer
(iii) Six's thermometer

Thermometer to measure our body temperature is

(i) Clinical or Doctor's thermometer.

Maximum thermometer records the _____(maximum/minimum) temperature of the day.

maximum

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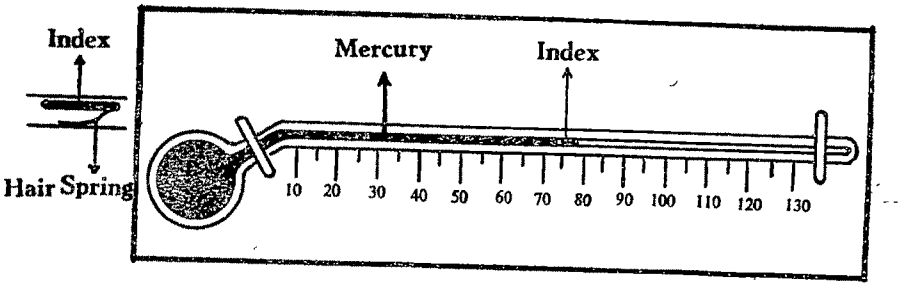
103. Maximum thermometer records the maximum temperature of the day. Observe the figure of the maximum thermometer carefully and recognize the parts before you proceed further.

THE MAXIMUM THERMOMETER



(a) The bulb and a part of the stem of the maximum thermometer are filled with _____.

(b) The steel index is above the level of _____.

(c) Look at the enlarged figure of steel index. It consists of a special part called hair _____.

(d) Hair spring is a part of steel _____.

(e) The scale is marked from ____°F to ____°F.

(a) mercury
(b) mercury
(c) spring
(d) index
(e) 10, 130

---

index hair spring	104. The steel index is shown separately in its enlarged form. It consists of two important parts namely _____ and _____ (any order).
(a) 10, 130 (b) away from	105. (a) The scale is marked from ____°F to ____°F. (b) The highest value of the scale (130°F) shown in the figure is _____ (near/away from) the bulb.
index	106. Above the level of mercury is a steel _____.
expands	107. When the temperature of the day rises, the mercury _____ (expands/contracts) and moves upwards.
above	108. The index is _____ (above/below) the level of mercury.
upwards	109. So the rising mercury pushes the index _____ (upwards/downwards).
maximum	110. The upward movement continues till the _____ (maximum/minimum) temperature is reached.
stops moving	111. When the maximum temperature is reached, the mercury stops moving. And, therefore, the steel index also _____ (stops moving/ moves further).
contracts	112. When the temperature falls, the mercury _____ (expands/contracts).
down	113. The contracting mercury moves _____ (up/down).

114. When the temperature falls, the steel index does not move with mercury because it is prevented by the hair _____.

spring

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115. When the temperature rises, mercury expands and pushes the index _____ (upwards/downwards) till the maximum temperature is reached.

upwards

---

116. When the temperature falls, mercury contracts and moves _____ (up/down).

down

---

117. But the steel index does not move because the hair spring prevents it from moving _____ (upwards/downwards).

downwards

---

118. The downward movement of the steel index is prevented by the _____ _____.

hair spring

---

119. The mercury level falls with fall in temperature. So the maximum temperature cannot be indicated by the level of _____.

mercury

---

120. Tickmark _/ the correct number of answer.

When the mercury falls, the steel index

(i) moves upwards ( )
(ii) moves downwards ( )
(iii) does not move ( )

(iii) _/

---

121. Maximum temperature of the day is recorded by the steady position of the _____ (mercury/index).

index

---

122. When the temperature falls, the level of _____ changes.

mercury

---

123. The index remains in the steady position showing the maximum temperature of the day because it is provided with _____.

hair spring

124. The maximum temperature of the day is recorded by the lower end of the _____.

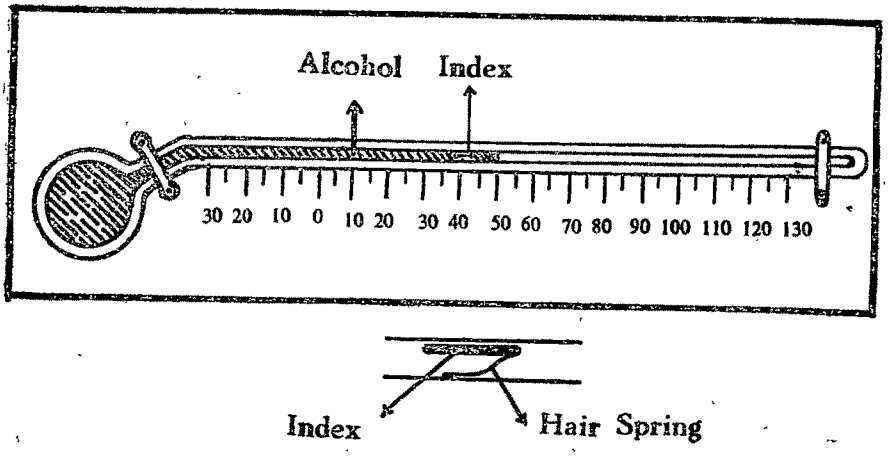
index

125. The minimum thermometer records the minimum temperature of the day.

Below is given a diagram of the minimum thermometer.

Observe the figure carefully and answer the following.

THE MINIMUM THERMOMETER



The bulb and a part of the stem are filled with _____.

alcohol

126. The steel index is _____ (above/below) the alcohol.

below

127. As the temperature of the day falls, the level of alcohol _____ (rises/falls).

falls

128. The scale extends below the 0°F on the _____ (lower/upper) side of the scale.

lower

129. So, can minimum thermometer record temperatures below the 0°F? _____ (Yes/No)

Yes

---

130. The index is provided with a _____.

hair spring

---

131. The steel index of the minimum thermometer is placed inside the _____ (alcohol/mercury).

alcohol

---

132. The steel index can move downwards only. Can the index move upwards? _____ (Yes/No)

No

---

133. When the temperature rises, alcohol _____ (expands/contracts) and moves upwards in the stem.

expands

---

134. The index _____ (will/will not) move upwards.

will not

---

135. When alcohol expands and moves upwards, the steel index _____ (moves upwards/ doesn't move).

doesn't move

---

136. The steel index does not move when the alcohol _____ (expands/contracts).

expands

---

137. When the temperature rises, alcohol expands and moves _____ (upwards/downwards).

upwards

---

138. The index is provided with a special part called the _____.

hair spring

---

139. The hair spring prevents the _____ from moving upwards.

index

---

140. So when the alcohol expands and moves upwards, the steady position of the index _____ (is/is not) changed.

is not

---

141. When the temperature falls, alcohol contracts and moves _____ (upwards/downwards).

downwards

---

142. When alcohol moves downwards, it drags the steel index _____ (upwards/downwards).

downwards

---

143. When the minimum temperature is reached, alcohol stops moving downwards. And steel index also _____ (stops moving/moves) downwards.

stops moving

---

144. The upward movement of the steel index of the minimum thermometer is prevented by the _____.

hair spring

---

145. Tickmark _/ the number of correct answer in the answer sheet.

When alcohol expands and moves upwards, the steel index

(i) moves upwards ( )
(ii) moves downwards ( )
(iii) does not move ( )

(iii) _/

---

146. Tickmark _/ the number of correct answer in the answersheet.

When alcohol contracts and moves downwards, the index

(i) moves upwards ( )
(ii) moves downwards ( )
(iii) does not move ( )

(ii) _/

---

147. The minimum temperature of the day is recorded by the upper end of the _____.

index

---

148. Tickmark _/ the number of correct answer.

The part that records the minimum temperature of the day is

(i) the level of alcohol ( )

(ii) upper end of the index ( )

(iii) lower end of the index ( )

(ii) _/

---

149. Before using the maximum or minimum thermometers a second time the position of the steel _____ is to be adjusted using a small magnet (magnet attracts steel).

index

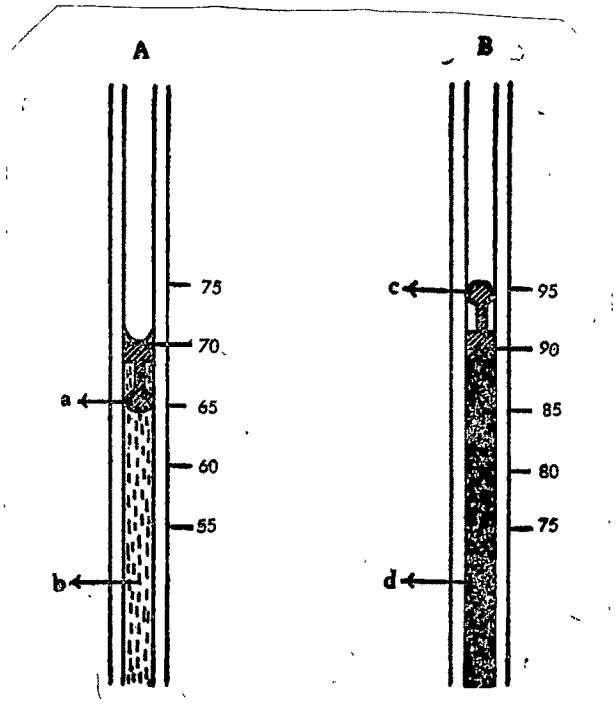
---

150. Using a magnet, the index of the minimum thermometer is to be brought _____ (above/inside) the alcohol.

inside

---

151. In the figure, the position of the indices of maximum thermometer and minimum thermometer are given. Observe the figure carefully and answer the following.



(i) minimum
(ii) maximum

(i) The figure A shows the _____ (maximum/minimum) thermometer.
(ii) The figure B shows the _____ (maximum/minimum) thermometer.

---

above

152. In the maximum thermometer the index is _____ (above/inside) the mercury.

---

alcohol

153. In the minimum thermometer the index is inside the _____ (write the name of the liquid).

70

154. The upper end of the index in the minimum thermometer is at _____ °F.

90

155. The lower end of the index in the maximum thermometer is at _____ °F.

---

maximum

156. 90°F indicates the _____ (maximum/minimum) temperature of the day.

70

157. Minimum temperature of the day is _____ °F.

---

lower

158. Maximum temperature is recorded by the _____ (upper/lower) end of the index.

---

159. Tickmark _/ the number of TWO special parts of the maximum and minimum thermometers not found in common thermometers :

	(a) Scale	( )
	(b) Glass tube	( )
	(c) Hair spring	( )
	(d) Bulb	( )
(c) _/	(e) Index	( )
(e) _/	(f) Mercury	( )

---

160. Below is given a table comparing the maximum and minimum thermometers. Column I gives the points of comparison and alternative answers. Fill in the blanks in Columns II and III by selecting the correct words given in brackets in Column I.

I	II Maximum thermometer	III Minimum thermometer
1. Liquid used is (alcohol/mercury).	_____	_____
2. Index is (above/inside) the liquid.	_____	_____
3. Index moves (downwards/upwards).	_____	_____
4. Temperature of the day is recorded by this end of the index (lower end/upper end).	_____	_____
5. Index moves when the liquid (falls/rises).	_____	_____

1. mercury alcohol
2. above, inside
3. upwards downwards
4. lower end upper end
5. rises, falls

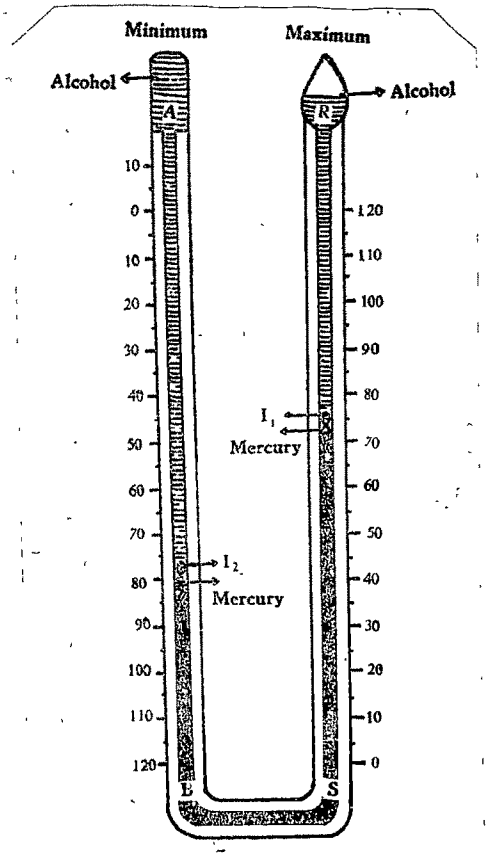
---

161. So far we have studied the maximum and minimum thermometer separately. We have a combined thermometer called Six's Thermometer, which reads both the maximum and minimum temperature of a _____ (day/substance).

day

---

162. Observe the figure of Six's thermometer carefully and answer the following questions :



SIX'S THERMOMETER

(a) U

(b) alcohol
mercury

(c) maximum
minimum

(d) maximum

(e) bottom, top

(a) Six's thermometer consists of a _____ shaped glass tube.

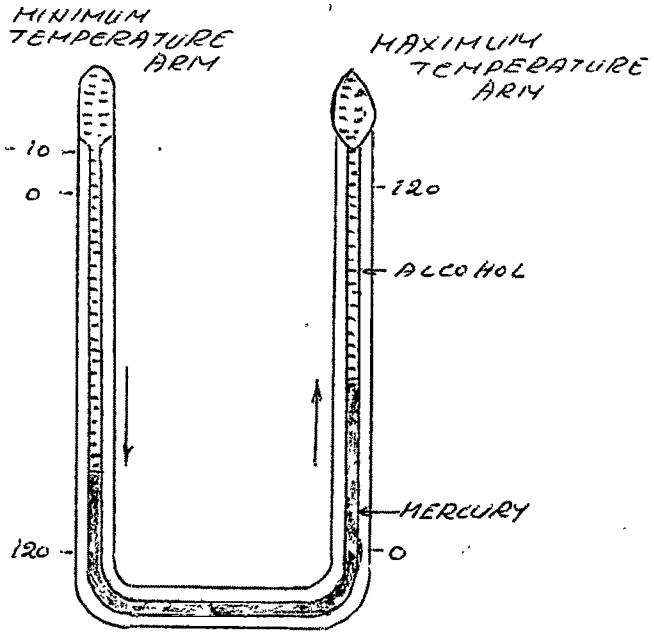
(b) Six's thermometer contains the liquids _____ and _____ (any order).

(c) It has two arms one for recording the _____ temperature and the other for recording the _____ temperature of the day (any order).

(d) There is a vacuum in the arm carrying the _____ (maximum/minimum) temperature scale.

(e) The maximum temperature scale starts from the _____ (bottom/top) while the minimum temperature scale starts from the _____.

163. Observe the figure carefully and answer the following frames :



When the temperature rises, the mercury and alcohol _____ (expand/contract) and mercury moves upwards in the maximum temperature arm.

expand

---

164. Both the maximum and minimum temperature arms of the Six's thermometer are _____ (disconnected/connected).

connected

---

165. The mercury in Six's thermometer _____ (can/cannot) flow from one arm to the other.

can

---

166. When the temperature rises, alcohol and mercury expand and move upwards in the maximum temperature arm. So mercury level _____ (rises/falls in the maximum temperature arm.

rises

---

167. When the temperature rises, mercury level rises in the _____ (maximum/minimum) temperature arm.

maximum

168. When the mercury level rises in one arm, it falls in the other arm. With rise in temperature, mercury level rises in the maximum temperature arm. Mercury level in the minimum temperature arm _____ (rises/falls).

falls

---

169. The index in the maximum temperature arm is above the level of _____.

mercury

---

170. The mercury while expanding pushes the index _____ (upwards/downwards) till the maximum temperature is reached.

upwards

---

171. When the maximum temperature is reached, the mercury does not rise further.

So at the maximum temperature the index _____ _____ (remains steady/moves further).

remains steady

---

172. Steel index does not move from its steady position because it is prevented by the _____.

hair spring

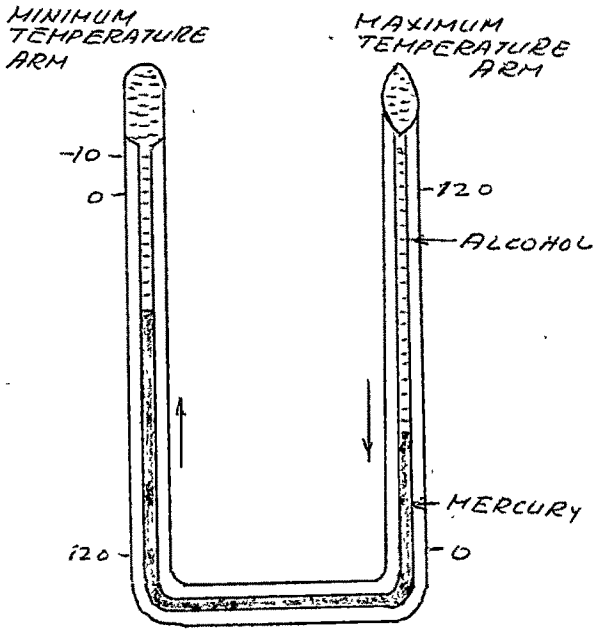
---

173. The scale of the maximum temperature arm starts from the bottom. So higher the position of the index, _____ (higher/lower) will be the temperature of the day.

higher

---

174. Observe the figure carefully and answer the following frames : 3



When the temperature falls, the level of mercury _____ (rises/falls) in the maximum temperature arm.

falls

---

175. When the temperature _____ (rises/falls), the mercury and alcohol contract.

falls

---

176. When the temperature falls, the level of mercury _____ (rises/falls) in the maximum temperature arm.

falls

---

177. Level of mercury rises in the _____ temperature arm.

minimum

---

178. The mercury in the minimum temperature arm moves upwards and pushes the _____ upwards.

index

---

179. When the temperature falls, the index in the minimum temperature arm moves _____ (upwards/downwards).

upwards

---

180. When the minimum temperature is reached, the index _____ (remains steady/moves further).

remains steady

---

181. Minimum temperature can be noted even after sometime because the _____ remains steady.

index

---

182. The scale in the minimum temperature arm starts from the top. So higher the position of the index, _____ (lower/higher) will be the temperature.

lower

---

183. In the Six's thermometer both the indices are above the level of _____.

mercury

---

184. In Six's thermometer both the indices are pushed _____ (upwards/downwards) by mercury.

upwards

---

185. The index in the maximum temperature arm is pushed upwards when the mercury _____ (expands/contracts).

expands

---

186. The index in the minimum temperature arm is pushed _____ (upwards/downwards) when the mercury contracts.

upwards

---

187. The temperature scale in the minimum temperature arm starts from the _____ (top/bottom).

top

---

188. Answer the following :

(a) Six's thermometer is a _____ shaped thermometer.

(a) U

(b) How many indices are there in the Six's thermometer? _____

(b) 2 or two

(c) What are the liquids used in the Six's thermometer? _____, _____(any order).

(c) mercury
alcohol

(d) In Six's thermometer, both the indices are pushed by _____ (alcohol/mercury).

(d) mercury

(e) In Six's thermometer, the maximum temperature scale starts from _____ (bottom/top) while the minimum temperature scale starts from the _____.

(e) bottom, top

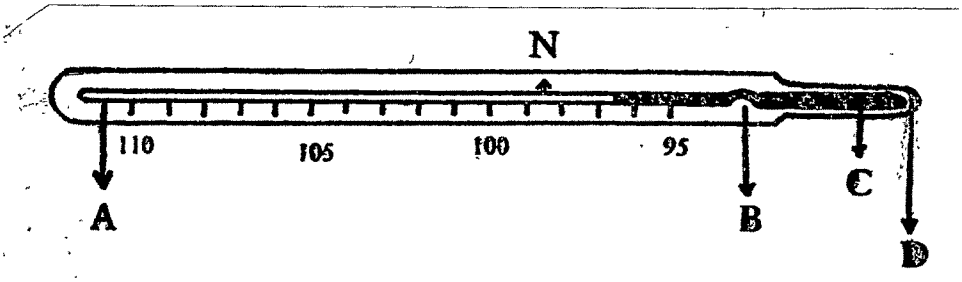
(f) In Six's thermometer, both the indices move _____ (upwards/downwards).

(f) upwards

189-A. Clinical thermometer is used to record the temperature of human body while Six's thermometer records the maximum and minimum temperatures of the day.

In the figure given below the parts of the clinica thermometer are marked by the different letters.

Part A : Shows the stem of the thermometer.
Part B : Shows the bent called constriction.
Part C : Shows mercury used in the thermometer.
Part D : Shows the bulb which is filled with mercury.
Part N : The arrow at N (98.4°F) shows the normal temperature.



Observe the figure and try to recognize the names of the parts. Now go to B part of this page.

189-B. Given below are the parts of the clinical thermometer. Observe the figure given above carefully and indicate which part is marked by which letter in the figure.

1. D — 1. Bulb is marked by the letter _____.
2. C — 2. Mercury is marked by the letter _____.
3. B — 3. Constriction is marked by the letter _____.
4. N — 4. Normal body temperature is marked by the letter _____.
5. 98.4 — 5. The value marked at N is _____°F.
6. A — 6. The stem is marked by the letter _____.

---

190. In order to measure the body temperature of the patient, the bulb of the _____ thermometer is put under the tongue or in the arm pit of the patient.

clinical

---

191. The mercury expands and moves upwards due to the _____ (rise/fall) in the body temperature of the patient.

rise

---

192. The special bent part above the bulb of the clinical thermometer is called the _____.

constriction

---

193. The constriction allows the mercury to pass through it in the upward direction only.

The constriction does not allow the mercury to move in the _____ (upward/downward) direction.

downward

---

194. In all the thermometers there is a part at the lower; and which is called the _____.

bulb

---

195. The bulb of the clinical thermometer contains _____. (Write the name of the liquid)

mercury

---

196. There is a special bent in the clinical thermometer called the constriction. The constriction is _____ (above/below) the bulb.

above

---

197. Constriction does not allow the _____ to move downwards.

mercury

---

198. So when the clinical thermometer is removed from the body, the mercury does not move downwards because it is prevented by the _____ (constriction/bulb).

constriction

---

199. The body temperature of a patient is indicated by the steady position of the _____.

mercury

---

200. When the patient has fever, the steady level of mercury _____ (above/below) the constriction indicates his body temperature.

above

---

201. After recording the temperature of a patient, the clinical thermometer should be shaken in order to bring the mercury _____ (downwards/upwards).

downwards

---

202. If the clinical thermometer is washed with water above 110°F _____ in the thermometer expands to a high temperature and forces through the glass and breaks the thermometer.

mercury

---

203. The temperature of boiling water is _____ (212°C/212°F).

212°F

---

204. The stem of the clinical thermometer is graduated upto _____ (110°C/110°F).

110°F

---

205. The maximum temperature to which the mercury in the clinical thermometer can expand in it is _____ (higher/lower) than the boiling point of water.

lower

---

206. So when the clinical thermometer is washed with the boiling water which is at 212°F, the mercury _____ (expands/contracts) too much. This breaks the clinical thermometer.

expands

---

207. Therefore clinical thermometer should be washed with _____ (boiling water/cold water).

cold water

---

208. Complete the following sentences by selecting the correct words from the list given below :

WORDS : magnet, index, bulb, hair spring, arrow, constriction, vacuum.

(a) vacuum — (a) The thermometer would burst at higher temperature if there is no _____ above the mercury in the thermometer.

(b) hair spring — (b) The steel index is prevented from moving by the _____.

(c) constriction. — (c) The back flow of mercury in clinical thermometer is prevented by the _____.

(d) magnet — (d) The index is rest using a small _____.

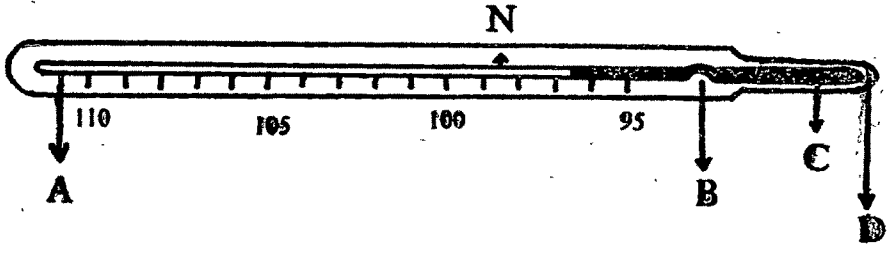
(e) index — (e) In Six's thermometer, the temperature of the day is indicated by the _____.

(f) bulb — (f) To measure the temperature of water, the _____ of the thermometer is immersed in it.

(g) arrow — (g) Normal body temperature (98.4°F) is shown in the clinical thermometer by the _____.

---

209. Below is given the diagram of clinical thermometer. Some parts of it are marked by A, B, C, D, and N. Write the names of the parts in the blanks provided below :



(1) Stem — (1) Part A is the _____

(2) Constriction — (2) Part B is the _____

(3) mercury — (3) Part C is the _____

(4) bulb — (4) Part D is the _____

(5) normal body temperature — (5) Arrow indicates the _____

(6) 98.4°F — (6) N is at the temperature of _____

Some interesting things about thermometers :

* Galileo at the end of 16th century prepared a water thermometer (the first thermometer).

* Amonton discovered that water always boiled at the same temperature at sea level.

* Fahrenheit discovered mercury to be the most suitable thermometric liquid. He constructed a mercury thermometer called Fahrenheit thermometer.

* Celsius constructed the Centigrade thermometer.

Answer the following :

(a) The use of mercury was discovered by .....

(b) The first thermometer was constructed by .....

(c) Centigrade thermometer was constructed by .....

(d) Steady boiling point of water was discovered by .....

Answers

(a) Fahrenheit
(b) Galileo
(c) Celsius
(d) Amonton

Answers are given on the left side of this page.

NOW THE PROGRAMME IS OVER

A PROGRAMMED TEXT ON THERMOMETER

BRANCHING FORM

About This Programme.....

On reading this programme, you will know many interesting things about thermometers. Thermometers are the instruments used to measure the heat levels. You have to know something about thermometers because we use them in hospitals, laboratories, houses and so on.

How to Read This Book

(1) You do not read this book as you read an ordinary book i.e. going from page 1 to 2, 3 etc.

(2) On every page, you will find a paragraph giving some information followed by a question.

(3) You can answer the question only if you read carefully and understand the central idea thoroughly.

(4) Each question is followed by two alternatives. You have to choose one of the alternatives and go to the page indicated by the side of each answer.

(5) Write your answer(s) of the exercise(s) in the answer sheet given to you. Do not write anything in this book.

(6) Most of the pages contain two parts A and B. You will be reading them separately.

(7) Now go to page No. 2-A and start reading.

READ the paragraph
READ the question
WRITE the answer
NOTE the page number given
by the side of the answer
PROCEED according to the page
indicated.

Page 2-A

When a substance is heated, its heat level rises. When a substance is cooled, its heat level falls. The heat level of a substance is called the temperature.

When a substance is heated, its temperature _____.

	Page
rises	4
falls	5-A

Page 2-B

Your answer was :

Ram concluded that by touching the water in the beaker B, its exact temperature could be known. Well, read the following and see how far your answer is correct.

Although Ram had dipped both the fingers in the tap water, his left hand finger felt a different heat level (cold) than the right hand finger (hot). He did not have the same experience with his two fingers.

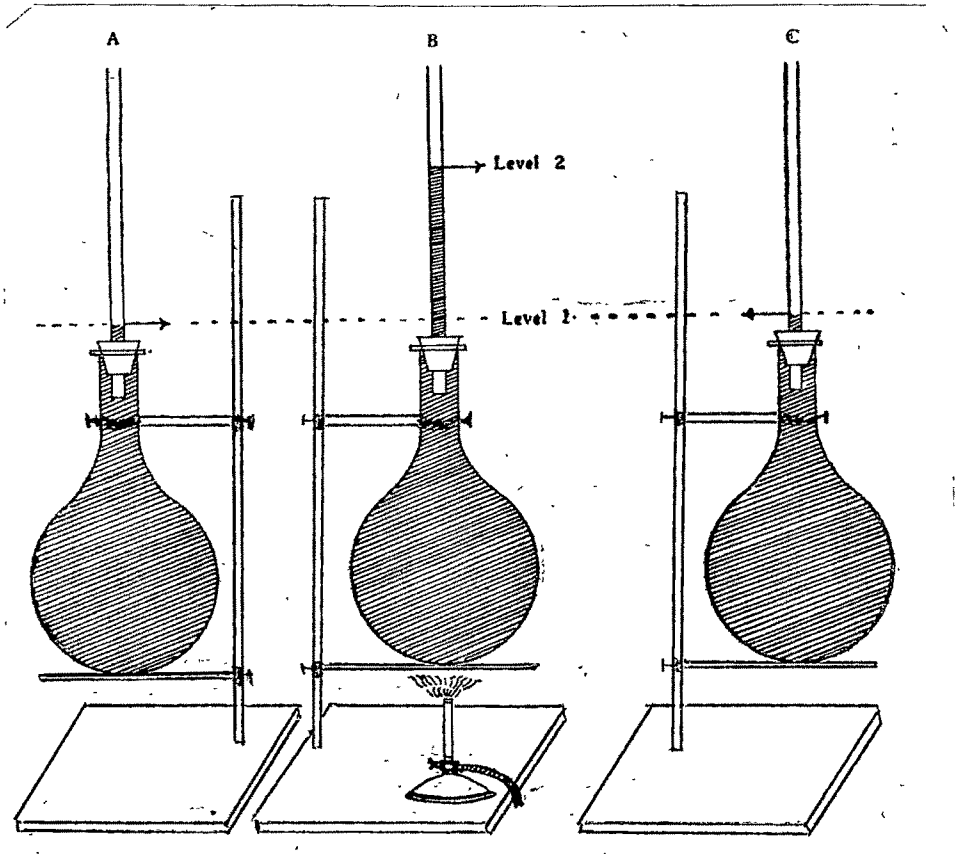
Study the material on Page 4.

Your answer was :

The accurate temperature of a substance can be known by a thermometer.

Yes, you are correct.

Let us study the principle on which thermometer is based.



Water in figure B is heated. Its level rises (from level 1 to level 2) and it occupies more space. Occupying more space on heating is called expansion (Fig. B). Water in figure C is cooled. Its temperature falls and it occupies less space. Occupying less space on cooling is called contraction.

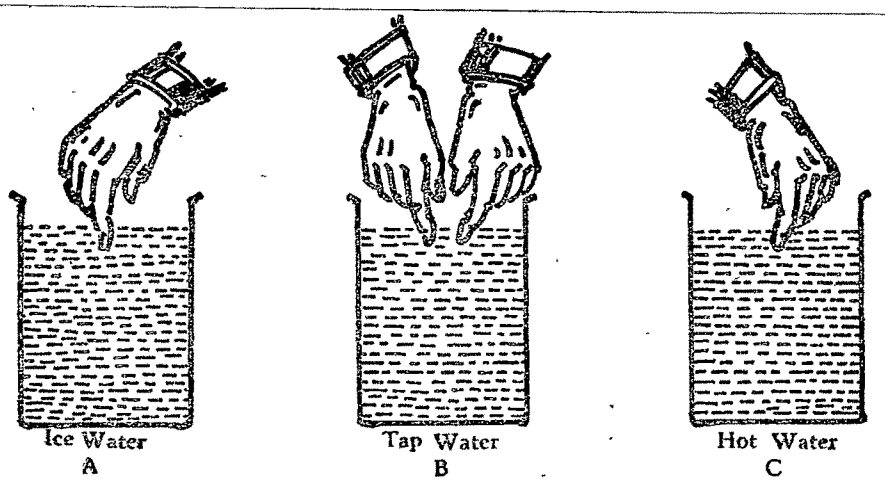
When the temperature of a substance rises, it _____.

	Page
expands	6-B
contracts	5-B

Your answer was :
When a substance is heated, its temperature rises.

Yes, you are right.

Now observe the figure carefully:



Ram dipped his right hand finger in A and left hand finger in C. Then he dipped both the fingers in B. To the right hand, the water in B was felt hot and to the left hand it was felt cold. Ram could not find out the accurate temperature of tap water because it was felt colder than the water in the beaker C and hotter than the water in the beaker A.

Ram concluded that by touching the water in the beaker B, its exact temperature.....

	Page
could be known	2-B
could not be known	6-A

Page 5-A

Your answer was :

When a substance is heated, its temperature falls. How can it be? Read the following and find out your mistake :

Ice water and boiling water differ in their heat levels.

The heat level of a substance is called its temperature. So we can say that the ice water and the boiling water differ in their temperature. When the ice water is heated, its heat level rises.

Study the material on Page 2-A.

Page 5-B

Your answer was :

When the heat level or temperature of a substance rises, it contracts.

Well, read the following and see where you have gone wrong :

When water is heated, its temperature rises and it occupies more space. This is expansion. When water is cooled, its temperature falls and it occupies less space. This is contraction.

Study the material on page 3.

Your answer was :

Ram concluded that by touching the water in the beaker B, its exact temperature could not be known. You are right.

By touching we can just know whether a substance is hot or cold. But its exact temperature cannot be known. To measure the temperature of a substance scientifically we need a thermometer.

Can we know the accurate temperature of a substance by using a thermometer?

	Page
Yes	3
No	7-A

Your answer was :

When the heat level of a substance rises, it expands.

Well, you are correct.

EXERCISE No. 1

Below are given some words related to expansion and contraction. Tickmark (_/) the number of those only related to contraction.

(i)	Cooling	( )
(ii)	Fall in temperature	( )
(iii)	Occupying less space	( )
(iv)	Rise in temperature	( )
(v)	Occupying more space	( )
(vi)	Heating	( )

Correct answers are given on Page 8-B.

Page 7-A

Your answer was :

The accurate temperature of a substance cannot be known by using a thermometer.

Is it really so?

By touching we cannot know the exact temperature of substances. In order to know the exact temperatures, we have to use a thermometer.

Study the material on Page 6-A

Page 7-B

Your answer was :

Vacuum allows the mercury to contract.

You have missed one important fact.

When the temperature rises, the mercury expands and occupies more space. When the temperature falls, mercury contracts and occupies less space.

So the extra space which is needed for expansion of mercury is provided by the vacuum. No extra space is needed for contraction.

Study the material on Page 14-A.

Correct answers for the Exercise No. 2

(1) The bulb is at the lower end of the glass tube.

(2) The bulb is filled with mercury.

(3)

(4) The Upper Point of the scale is marked as U.F.P.

(5) The Lower Point of the scale is marked as L.F.P.

If all your answers are correct, go to Page 12-A.

If some of your answers are wrong, go to Page 9.

Correct answers for the Exercise No. 1

The words related to contraction are :

(i) Cooling (_/)
(ii) Fall in temperature (_/)
(iii) Occupying less space (_/)

If all your answers are correct, go to Page 9.

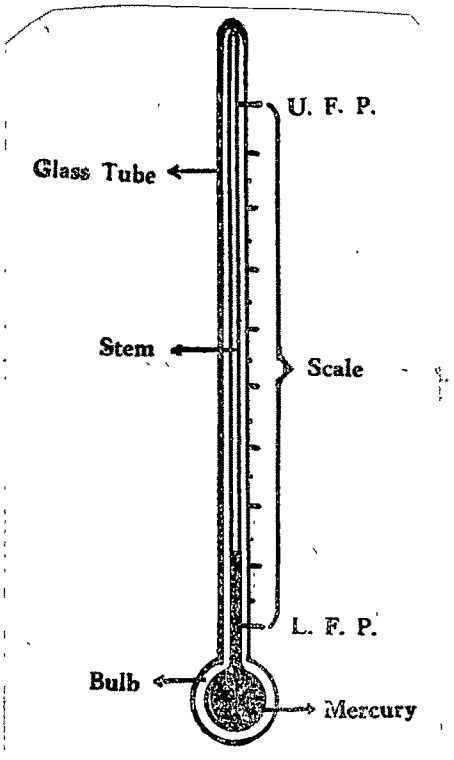
If some of your answers are wrong, go to Page 3.

Thermometer is constructed on the principle that liquids expand with the rise in temperature and contract with fall in temperature.

In the figure the thermometer is shown and its different parts are labelled.

EXERCISE No. 2

Observe the figure carefully and answer the following questions:



(1) The bulb is at the _____ (lower/upper) end of the glass tube.

(2) The bulb is filled with the _____.

(3) On the stem of the thermometer are marked some divisions of the temperature scale to measure temperature. (You are not required to answer this sentence).

Go to (4) below.

(4) The Upper Point of the scale is marked as _____.

(5) The Lower Point of the scale is marked as _____.

Answers are given on Page 8-A.

Page 10-A

Your answer was :

Mercury can be poured through the bulb. You did not think about it.

The funnel is at the upper end of the glass tube while the bulb is at its lower end.

There is a stem above the bulb. The bulb is to be filled with mercury.

Can we pour anything from the lower end?

Can we pour anything from the closed end?

Answer these questions in your mind and go to Page 12-A.

Page 10-B

Your answer was :

After sealing the upper end of the tube there is air above the mercury level.

Well, you might have some difficulty in understanding the process of constructing the thermometer.

O.K. proceed in this way.

Suppose there is a beaker containing some water. Then the upper part of the beaker which does not contain water is filled with air.

Similarly, the glass tube contains mercury to some level.

The remaining glass tube contains air inside it. When mercury is heated, it expands and occupies the entire glass tube. Thus, the air is driven out. Immediately the upper end is closed.

Now study the material on Page 13.

Your answer was :

Vacuum allows the mercury to expand.

That is correct. Now read the following.

Mercury has some special characteristics because of which it is used in the common thermometers.

*Temperature is recorded by looking at the level of mercury. Mercury is shining liquid and so its level can be seen clearly.

*Mercury shows the exact levels because it does not wet the glass.

*Being a good conductor of heat, it is highly sensitive to even small changes in temperature.

EXERCISE No. 3

Answer the following questions.

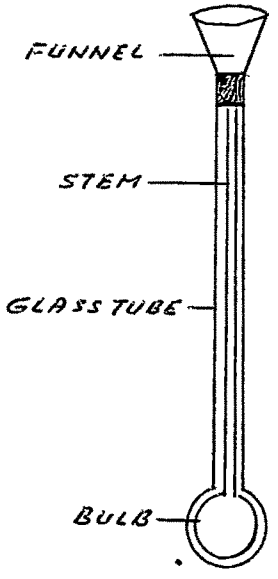
(1) Does the mercury wet the glass? _____ (Yes/No)

(2) The level of mercury can be easily seen in the thermometer because it is a _____ liquid.

(3) Can you find out small changes in temperature using a bad conductor of heat? _____ (Yes/No)

Correct answers are given on Page 15-A.

Let us see the material used in
the construction of the thermometer.
Observe the figure carefully.



A glass tube with narrow and uniform bore is taken.
Its lower end contains a bulb which is to be filled with the
mercury. Its upper end is in the shape of a funnel.
The mercury can be poured through the _____.

	Page
Bulb	10-A
funnel	13

Small changes in temperature cannot be measured using a bad conductor of heat.

Bad conductors of heat are not sensitive to changes in temperature. So they cannot indicate small changes in temperature.

Mercury is not a bad conductor of heat.

That is why mercury is used in thermometers.

Go to Page No. 14-B.

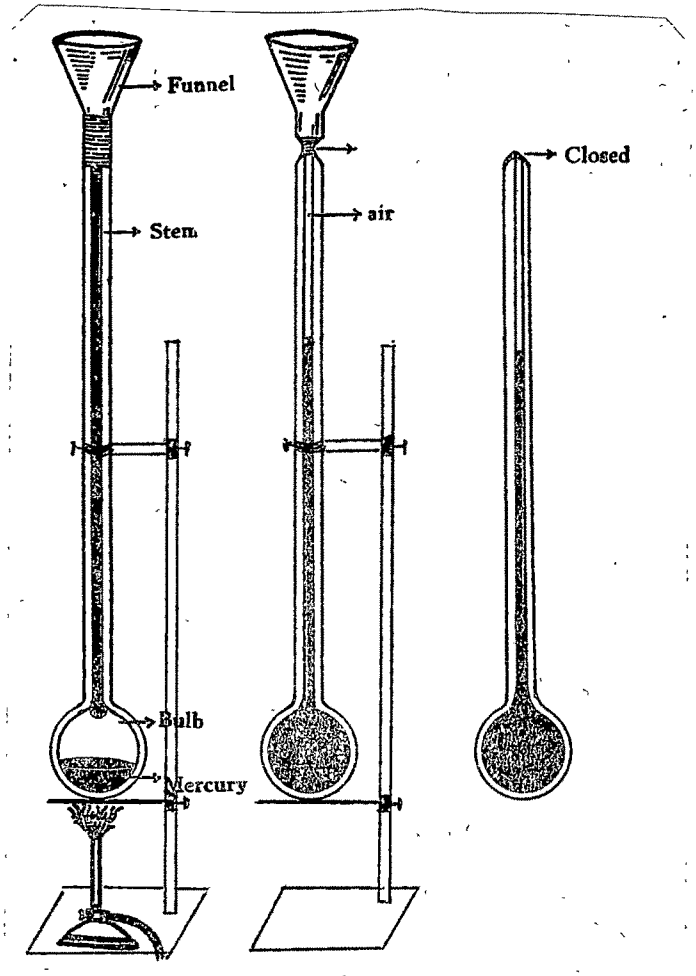
Your answer was :

Mercury can be poured through the funnel.

Yes, you are right.

In the figure, the construction of the thermometer is shown.

Observe the figure carefully.



Mercury is poured through the funnel and the bulb is heated. Mercury expands and drives some air out. Then it is cooled. Some mercury gets into the bulb. Heating and cooling are repeated till the entire bulb and a part of the stem are filled with mercury.

Then the mercury is strongly heated in order to drive all the air out of the stem. Thus, a vacuum is created. Then the upper end is closed and it is cooled down.

After sealing the upper end, what do we have above the mercury level?

	Page
Air	10-B
no air (vacuum)	14-A

Your answer was :

After sealing the upper end, there is no air above the mercury level. Yes, you are right.

So we have a vacuum above the mercury. At higher temperatures mercury needs more space for expansion. The thermometer will be broken by the expanding mercury if there is air inside it. Vacuum allows the mercury to _____.

	Page
expand	11
contract	7-B

EXERCISE No. 4

Of the following, tickmark (_/) the number of those statements which describe why mercury is used in the thermometers.

(a) Mercury cannot be seen through the glass. ( )

(b) Mercury is sensitive to even small changes in temperature. ( )

(c) Mercury does not wet the glass. ( )

(d) Mercury expands or contracts very slowly. ( )

(e) Mercury can be seen through the glass. ( )

(f) Mercury is a shining solid. ( )

(g) Mercury is a shining liquid. ( )

(h) Mercury sticks to the glass. ( )

Correct answers are given on Page 15-B.

Correct answers for the EXERCISE No. 3

(1) No

(2) Shining

(3) No

If all your answers are correct, go to Page 12-B.

If any of your answers are wrong, go to Page 11.

Correct answers for the EXERCISE No. 4

Mercury is used in the thermometers because

(b) Mercury is sensitive to even small changes in temperature (_/)

(c) Mercury does not wet the glass (_/)

(e) Mercury can be seen through the glass (_/)

(g) Mercury is a shining liquid (_/)

If all the four answers are correct, go to Page 18.

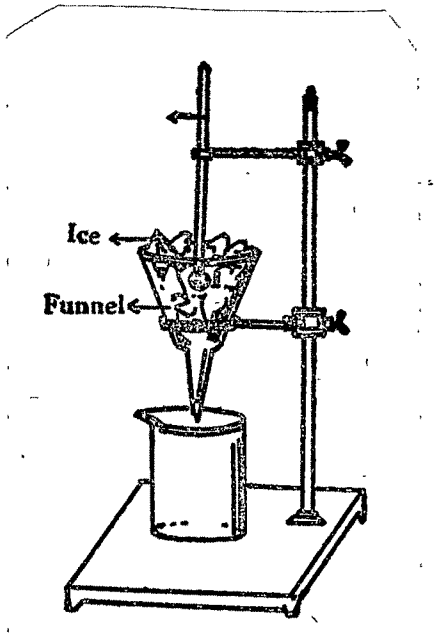
If some of your answers are wrong, go to Page 11.

Your answer is that :

U.F.P. indicates the boiling point of water.

Yes, you are right.

U.F.P. is the upper fixed point. At the lower end of the temperature scale we have the lower fixed point (L.F.P.). Let us see how this L.F.P. is marked.



MARKING THE L. F. P.

Bulb of the thermometer is kept in a funnel containing melting ice. Mercury level begins falling and it remains steady after some time. Mercury level remains steady because ice always melts at the same temperature. This steady point is marked as the L.F.P.

L.F.P. indicates the melting point of ice.

	Page
Yes	21-A
No	19-A

Page 17-A

Your answer was :

U.F.P. does not indicate the boiling point of water.

Well, read the following and see whether you are right.

Boiling point of water indicates the steady temperature at which water boils. When water boils, the mercury level in the tube remains steady which is marked as U.F.P.

Study the material on Page 18.

Page 17-B

Your answer was :

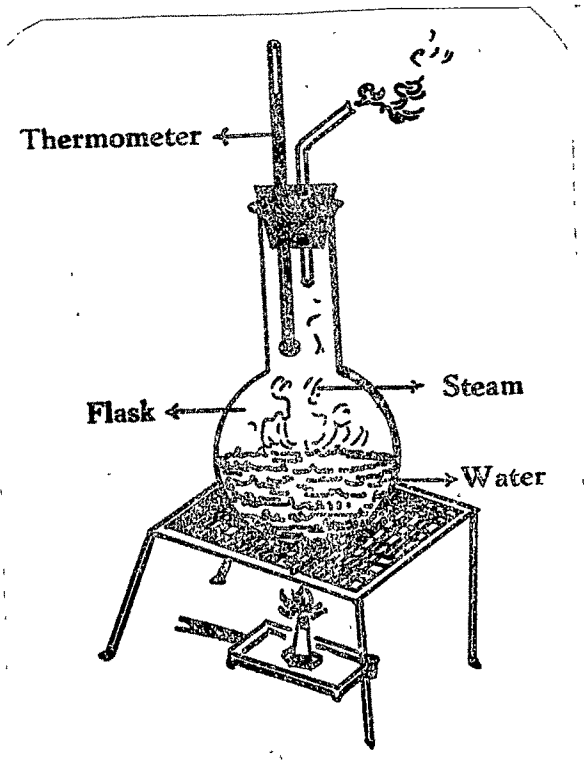
By marking the divisions and numbers we get the U.F.P. or L.F.P.

How can it be?

U.F.P. is the upper fixed point of the temperature scale. L.F.P. is the lower fixed point of the temperature scale. After marking the U.F.P. and L.F.P. only, many divisions and numbers will be marked inbetween the U.F.P. and L.F.P. Thus the temperature scale will be marked on the thermometer.

Study the material on Page 21-A.

You already know that at the upper end of the temperature scale we have Upper Fixed Point (U.F.P.). Below is given the method of marking the U.F.P.



MARKING THE U. F. P.

The bulb of the thermometer is kept above the level of water taken in the flask. The flask is heated and the mercury level begins rising. When the temperature reaches the boiling point of water, the mercury level does not rise further.

The point where mercury level remains steady is marked as the U.F.P.

U.F.P. indicates the boiling point of water.

	Page
Yes	16
No	17-A

Page 19-A

Your answer was :

L.F.P. does not indicate the melting point of the ice.

Well, read the following and see whether you are right.

Melting point of ice means the steady temperature at which ice melts. In melting ice, the mercury level of the thermometer falls and after some time it remains steady. This steady point is marked as L.F.P.

Study the material on Page 16.

Page 19-B

Your answer was :

When the mercury level in the thermometer is high, the temperature of water is low.

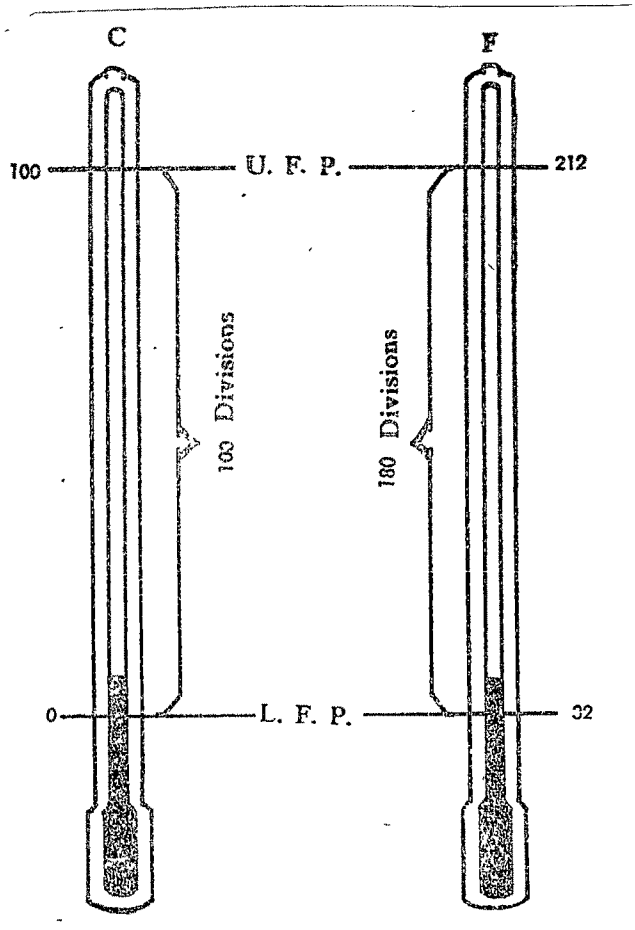
How can it be?

The temperature of water at 50°c is more than the water at 40°C. So the level of mercury at 50°C will be higher than that at 40°C.

Study the material on Page 28-B.

EXERCISE No. 5

Below are shown the differences between the Centigrade (C) scale and Fahreneit (F) scale.



(i) L.F.P. in C scale is 0°C which is just equal to ___°F.

(ii) U.F.P. in C scale is 100°C which is just equal to _____°F.

(iii) C scale contains _____ divisions.

(iv) F scale contains _____ divisions.

(v) Using a Centigrade scale, can we measure temperatures above 100°C? Yes/No

Correct answers are given on Page 25-A.

Your answer was :

L.F.P. indicates the melting point of ice.

Yes, you are right.

At the melting point of ice the mercury level remains steady. This is marked as the L.F.P. There are many divisions and numbers marked in between the L.F.P. and U.F.P. The process of marking these divisions and numbers is called graduating the thermometer.

U.F.P. and L.F.P. are marked even before marking the divisions and numbers of the thermometer.

By marking the divisions and numbers, we get the .....

	Page
U.F.P. and L.F.P.	17-B
temperature scale	22-B

Correct answer for the EXERCISE No. 6

(i) L.F.P. : Lower Fixed Point

(ii) ° : Degree

(iii) °C : Degree Centigrade

(iv) U.F.P. : Upper Fixed Point

(v) C : Centigrade

If all your answers are correct, go to Page 22-A.

If there are some mistakes in your answers, go to Page 25-B.

EXERCISE No. 7

Compare the Centigrade and Fahrenheit scales

	Centigrade	Fahrenheit
(a) U.F.P. is	_____	_____
(b) L.F.P. is	_____	_____
(c) Number of divisions are	_____	_____

Correct answers are given on Page 24-A

Your answer was :

By making the divisions and numbers, we get the temperature scale. Yes, you are right.

There are two types of thermometers based on the temperature scale marked on them.

(i) Centigrade thermometer on which Centigrade or C scale is marked.

(ii) Fahrenheit thermometer on which Fahrenheit or F scale is marked.

Study the material on Page 20.

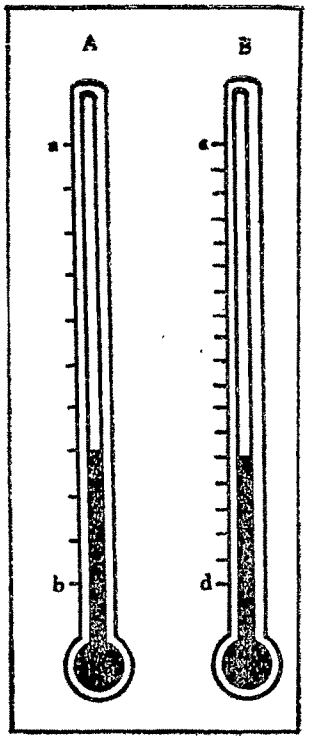
EXERCISE No. 8

Observe the figure carefully.

The parts of the two thermometers with their U.F.P. and L.F.P. are shown. You have to write the values of those points in the blanks given below.

Figure A shows the scale that contains 100 divisions.

Figure B shows the scale that contains 180 divisions.



Fill in the blanks

A. (1) The figure 'A' shows the _____ (Centigrade/ Fahrenheit) thermometer

(2) The figure 'B' shows the _____ (Centigrade/ Fahrenheit) thermometer

B. (1) Value at 'a' is _____ (100°C/212°F)
(2) Value at 'b' is _____ (0°C/32°C)
(3) Value at 'c' is _____ " "
(4) Value at 'd' is _____

The correct answers are given on Page 24-B.

Answers for the EXERCISE No. 7

Compare the Centigrade and Fahrenheit scales.

	Centigrade	Fahrenheit
(a) U.F.P. is	100°C	212°F
(b) L.F.P. is	0°C	32°F
(c) Number of divisions are	100"	180"

If all your answers are correct, go to Page 23.

If any of your answers are wrong, go to Page 25-B.

Correct answers for the EXERCISE No. 8

Labelling the C and F scale values

A. (1) The figure 'A' shows the Centigrade thermometer.
(2) The figure 'B' shows the Fahrenheit thermometer.

B. (1) Value at 'a' is 100°C
(2) Value at 'b' is 0°C
(3) Value at 'c' is 212°F
(4) Value at 'd' is 32°F

If all your answers are correct, go to Page 26-B.

If there are any mistakes, go to Page 25-B.

Correct answers for the EXERCISE No. 5

(i) 32
(ii) 212
(iii) 100
(iv) 180
(v) No

If all your answers are correct, go to Page 26-A.

If some of your answers are wrong, go to Page 20.

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* Lower fixed point of C scale is 0°C and that of F scale is 32°F.
* Temperatures below the zero degree are written with a minus sign. e.g. -10°C, -18°F etc.
* The U.F.P. of C scale is 100°C and that of F scale is 212°F.
* The U.F.P. of both C and F indicate the temperature of boiling water. So the highest temperature recorded by C and F is the same but in different units.
* F scale contains 180 divisions between the U.F.P. and L.F.P. while C scale has 100 divisions.

Note :-

If you are coming from Page 21-B, go back to Page 26-A.
If you are coming from Page 24-A, go back to Page 22-A.
If you are coming from Page 24-B, go back to Page 23.

EXERCISE No. 6

What the following abbreviations and symbols stand for?

(i) L.F.P. .....

(ii) ° .....

(iii) °C .....

(iv) U.F.P. .....

(v) F .....

(vi) C .....

Correct answers are given on Page 21-B

Using a C scale we cannot measure any temperature higher than 100°C.

100 degrees Centigrade (100°C) is just equal to 212°F.

The numbers are different but both measure the temperature of boiling water. So F scale does not measure anything higher than what C scale does.

Temperatures below the zero are written with a minus sign. e.g. -20°C, -40°F, -11°C etc.

Minus seven degrees Fahrenheit (-7°F) is a temperature which is .....

	Page
above the 0°F	27-B
below the 0°C	27-A
below the 0°F	28-B

Page 27-A

Your answer was :

Minus seven degrees Fahrenheit (-7°F) is a temperature which is below 0°C.

As far as the minus sign is concerned, you have done it fine. You know that it is below the zero degree. But you forgot to notice the type of scale used, that is, I mean whether it is Centigrade or Fahrenheit. F stands for Fahrenheit scale and C stands for Centigrade scale.

Study the material on Page 26-B.

Page 27-B

Your answer was :

Minus seven degrees Fahrenheit (-7°F) is a temperature which is above the 0°F.

Read the following and see how far you are correct.

-21°C is different from 21°C.

21°C is a temperature above the 0°C whereas -21°C is below the 0°C.

Temperatures below the zero degree are written with a minus sign. e.g. -21°C.

Study the material on Page 26-B.

Your answer was :

If the mercury level is higher, we can say that the temperature is higher. Yes, you are right.

EXERCISE No. 9

Below are given the steps followed in using a thermometer. But it is not given in the proper order-

Write the correct order of the steps in the brackets.

1. ..... Final recording of temperature, for example 51°Centigrade. ( )
2. ..... Mercury level of thermometer changes ( )
3. ..... Bulb of the thermometer is put in the liquid. ( )
4. ..... Main scale division near the mercury level is noted. ( )

Correct answers are given on Page 29-A.

Your answer was :

-7°F is a temperature below the 0°F. Yes, you are right.

The temperature below the zero degree of Fahrenheit or Centigrade is indicated by a minus sign. e.g. -20°C, -41°F.

To find the temperature of hot water, the bulb of the thermometer is immersed in hot water. There is a rise in the mercury level. The number marked on the main scale division to which mercury rises gives the temperature of hot water.

When the mercury level in the thermometer is high, we can say that the temperature of water is comparatively _____.

	Page
Low	19-B
high	28-A

Correct answers for the EXERCISE No. 9

The correct order in using the thermometer.

51° Centigrade (Final recording of temperature). (4)
Mercury level changes (2)
Bulb of the thermometer is put in the liquid. (1)
Main scale division near the mercury level is noted. (3)

If your answers are all right, go to Page 29-B.

If there are any mistakes, go to Page 28-B.

Common thermometers are used to measure the temperature of a substance. To measure the atmospheric temperature of a day, that is, the maximum and minimum temperature of a day, or the body temperature of a patient, we need some special thermometers.

Thermometers which record the atmospheric temperatures of a day :

(i) Maximum thermometer
(ii) Minimum thermometer
(iii) Six's thermometer

Thermometer to measure our body temperature :

(i) Clinical or Doctor's Thermometer.

Study the material on Page 31.

Your answer was :

When the mercury expands due to rise in the temperature, the steel index is pushed downwards.

Oh, no! When the temperature rises, the mercury expands. As there is vacuum on the upper side of the thermometer, the level of mercury rises upwards.

The steel index is placed over the level of mercury which moves upwards.

Study the material on Page 32-A.

Your answer was :

The maximum temperature is recorded by the steady position of the mercury level.

Read the following and rethink about it.

When the temperature changes, the mercury level also changes due to expansion or contraction. So it does not remain in the steady level but rises with rise in temperature and falls with fall in temperature.

But the steel index does not move from its steady position because of the hair spring.

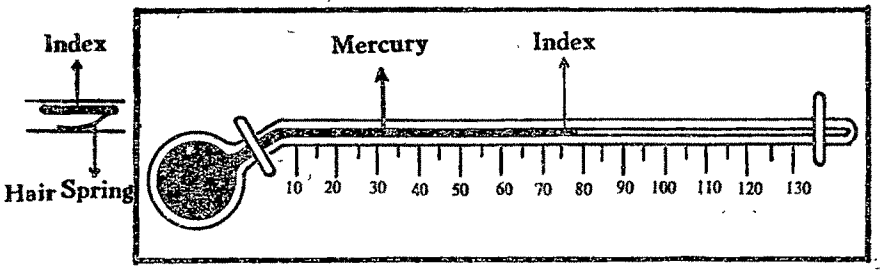
Study the material on Page 32-B.

Maximum thermometer records the maximum temperature of the day.

EXERCISE No. 10

Observe carefully the diagram of the maximum thermometer.

THE MAXIMUM THERMOMETER



(1) The bulb and a part of the stem of the maximum thermometer are filled with _____.

(2) The steel index is above the level of _____.

(3) The steel index is shown separately in its enlarged form. It consists of two important parts namely _____ and _____.

(4) The scale is marked from _____°F to _____°F.

(5) The highest value of the scale (130°F) shown in the figure is _____ (near/away from) the bulb.

Correct answers are given on Page 33-A.

Page 32-A

The index of the maximum thermometer is above the mercury level. So when the mercury expands and moves upwards due to rise in the temperature, the index is pushed _____.

	Page
upwards	32-B
downwards	30-A

Page 32-B

Your answer was :

When the mercury expands due to rise in temperature, the steel index is pushed upwards. Yes, you are correct.

This is because the steel index is on the mercury level and so it is pushed upwards along with the rising mercury.

This upward movement continues till the maximum temperature is reached. When the maximum temperature is reached the mercury does not rise further. When the temperature falls, mercury contracts and moves downwards. But the hair spring attached to the steel index prevents the index from moving.

Maximum temperature is recorded by the steady position of the _____.

	Page
Mercury level	30-B
steel index	33-B

Correct answers for the EXERCISE No. 10

(1) The bulb and a part of the stem of the maximum thermometer are filled with mercury.

(2) The steel index is above the level of mercury.

(3) The steel index consists of two important parts namely index and hair spring.

(4) The scale is from 10°F to 130°F.

(5) 130°F shown in the figure is away from the bulb.

If all your answers are correct, go to Page 32-A.

If some of your answers are wrong, go to Page 31.

Your answer was :

Maximum temperature is recorded by the steady position of the steel index. You are correct.

When the temperature changes, the mercury level also changes. But the steel index does not change because of the hair spring.

The lower end of the index shows the maximum temperature.

The index moves upwards according to the maximum temperature. So the next day the index is brought to the level of mercury using a small magnet (magnet attracts steel).

Study the material on Page 36.

Page 34-A

Your answer was :

When the alcohol expands and moves upwards, the steel index does not move. That is correct.

Steel index can be dragged downwards by the contracting alcohol. But it cannot be pushed upwards. The hair spring prevents it from moving upwards.

The upper end of the index records the minimum temperature of the day.

The position of the index is adjusted with the help of a magnet (i.e., the index is brought inside the alcohol).

Study the material on Page 42-B.

Page 34-B

When the temperature rises, alcohol expands and flows past the index without changing its position. The hair spring prevents the index from moving upwards.

When the temperature falls, alcohol contracts and moves downwards. It drags the index along with it downwards. The index continues moving downwards till the minimum temperature is reached.

When alcohol expands and moves upwards, the steel index .....

	Page
moves downwards	35-A
doesn't move	34-A

Page 35-A

Your answer was :

When the alcohol expands and moves upwards, the steel index also moves upwards.

Read the following and rethink about it.

When the alcohol expands, it moves upwards. So in the ordinary situation the steel index should also move upwards. But the hair spring prevents the index from moving.

Study the material on Page 34-B.

Page 35-B

Your answer was :

When the temperature falls, the index in the minimum temperature arm moves downwards.

O.K. read the following and see how far you are correct.

Minimum temperature arm is for recording the minimum temperature of the day. When the temperature falls, mercury contracts and its level falls in the maximum temperature arm but rises in the minimum temperature arm. So the mercury moves upwards in the minimum temperature arm when mercury moves upwards due to fall in temperature the index is pushed upwards by the mercury.

Study the material on Page 44-B.

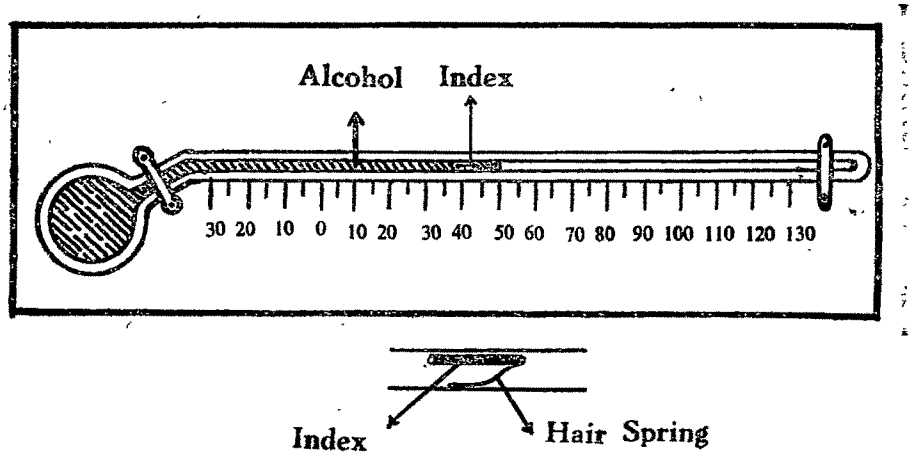
The minimum thermometer records the minimum temperature of the day.

EXERCISE No. 11

Below is given a diagram of the minimum thermometer.

Observe the figure carefully and answer the following.

THE MINIMUM THERMOMETER



(1) The bulb and a part of the stem are filled with _____.

(2) The steel index is _____ (above/inside) the level of alcohol.

(3) As the temperature of the day falls, the level of alcohol _____ (rises/falls).

(4) The scale extends below the 0°F on the lower side of the scale.

So, the minimum thermometer record temperatures below the 0°F?

Yes/No

Correct answers are given on Page 38-A.

Answers for the EXERCISE No. 13

(a) The Figure A shows the minimum thermometer.

(a') The figure B shows the maximum thermometer.

(b) In the maximum thermometer the index is above the mercury.

(c) In the minimum thermometer, the index is inside the alcohol.

(d) The upper end of the index in the minimum thermometer is at 70°F.

(e) The lower end of the index in the maximum thermometer is at 90°F.

(f) 90°F indicates the maximum temperature of the day.

(g) Minimum temperature of the day is 90°F.

(h) Maximum temperature is recorded by the lower end of the index.

If all the answers are correct, go to Page 37-B.

If some of your answers are wrong, go to Page 40-B.

EXERCISE No. 14

Below is given a table comparing the maximum and minimum thermometers. Column I gives the points of comparison and alternative answers. Fill in the blanks in columns II and III by selecting the correct words given in the brackets in column I.

I Points of comparison	II Maximum thermometer	III Minimum thermometer
1. Liquids used is (alcohol/ mercury).	_____	_____
2. Index is (above/inside) the liquid.	_____	_____
3. Index moves (upwards/downwards).	_____	_____
4. Temperature of the day is recorded by this end of the index (lower/upper).	_____	_____
5. Index moves when the liquid (rises/falls).	_____	_____

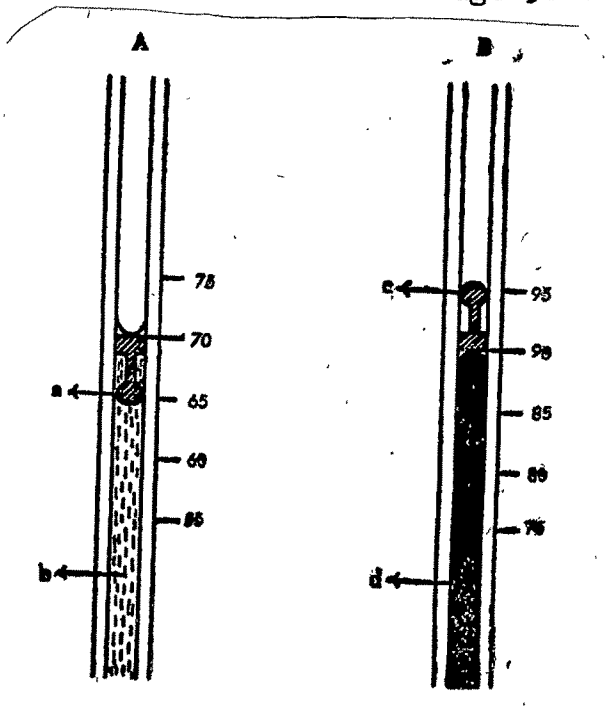
Correct answers for the EXERCISE No. 11

(1) The bulb and a part of the stem are filled with alcohol.
(2) The index is inside the level of alcohol.
(3) As the temperature of the day falls, the level of alcohol falls.
(4) Yes, the minimum thermometer can record temperatures below the 0°F.

If all your answers are correct, go to Page 34-B.
If some of your answers are wrong, go to Page 36.

EXERCISE No. 13

In the figure, the positions of the indices of maximum thermometer and minimum thermometer are given. Observe the figure carefully and answer the following.



(a) The figure A shows the _____ (maximum/minimum) thermometer.
(a') The figure B shows the _____ (maximum/minimum) thermometer.
(b) In the maximum thermometer the index is _____ (above/inside) the mercury.
(c) In the minimum thermometer the index is inside the _____ (write the name of the liquid).
(d) The upper end of the index in the minimum thermometer is at _____°F.
(e) The lower end of the index in the maximum thermometer is at _____°F.
(f) 90°F indicates the _____ (maximum/minimum) temperature of the day.
(g) Minimum temperature of the day is _____°F.
(h) Maximum temperature is recorded by the _____ (upper/lower) end of the index.

Correct answers are given on Page 37-A.

Answers for the EXERCISE No. 14

Comparison of maximum and minimum thermometers.

		Maximum thermometer	Minimum thermometer
1.	Liquid used is	mercury	alcohol
2.	Index is	above the liquid	inside the liquid
3.	Index moves	upwards	downwards
4.	Temperature of the day is recorded by the	lower end	upper end
5.	Index moves when the liquid	rises	falls

If all your answers are correct, go to Page 41.

If some of your answers are wrong, go to Page 40-B.

Answers for the EXERCISE No. 12

The two special parts of the maximum and minimum thermometers are :

(c) Hair spring (_/)

(e) Index (_/)

If both are correct, go to Page 38-B.

If any mistakes are there, go to Page 40-B.

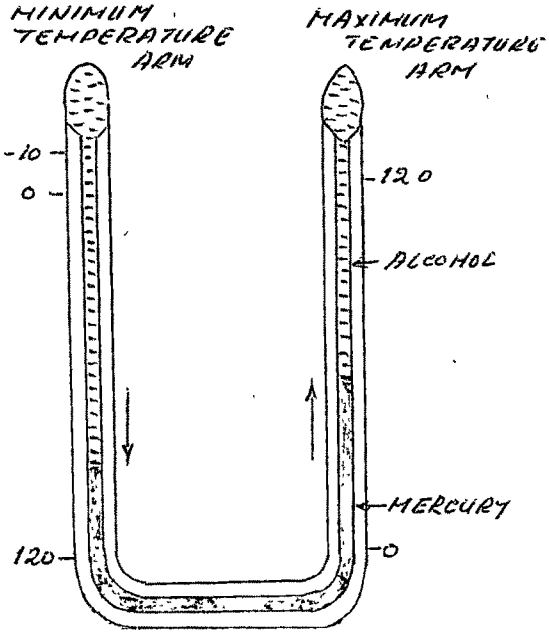
Page 40-A

Your answer was :

When the temperature rises, the mercury level in the minimum temperature arm rises. Read the following carefully and find your mistake.

Six's thermometer is made up of a U tube which contains mercury and alcohol in it. If mercury rises and moves upwards in one arm, it will move in the opposite direction in the other arm.

When the temperature rises, mercury and alcohol expand. Mercury level rises in the maximum temperature arm. So mercury in the minimum temperature arm moves downwards.



Go to Page 42-A

Page 40-B

** In the maximum thermometer, the steel index is above the level of mercury. So the index moves upwards along with the expanding mercury. The lower end of the index indicates the maximum temperature of the day.

** In the minimum thermometer the index is inside the alcohol. When alcohol contracts, its level falls. The index is dragged downwards along with the falling alcohol. The upper end of the index records the minimum temperature of the day.

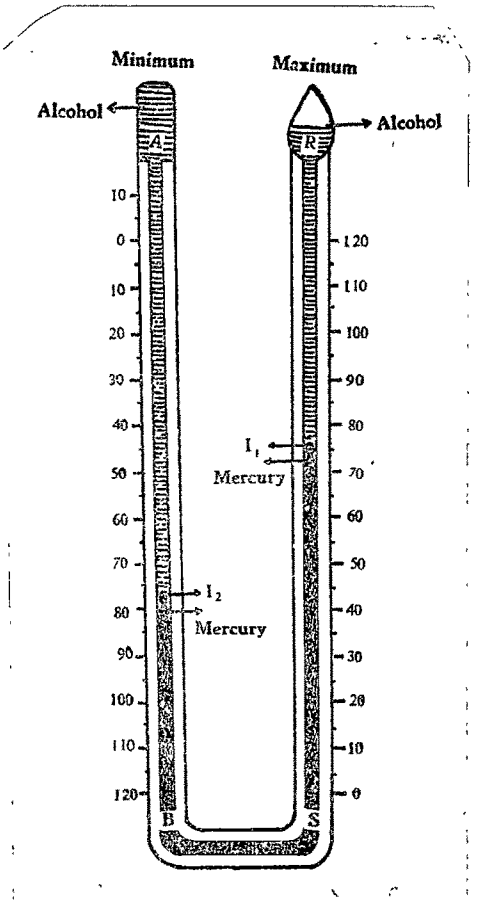
** The hair spring keeps the index in its steady position.

NOTE: If you are coming from Page 37-A, go back to Page 38-B.
If you are coming from Page 39-A, go back to Page 37-B.
If you are coming from Page 39-B, go back to Page 42-B.

So far we have studied the maximum and minimum thermometers separately. Now let us study Six's thermometer.

EXERCISE No. 15

Observe the figure of Six's thermometer carefully and answer the following questions.



SIX'S THERMOMETER

(1) Six's thermometer consists of a _____ shaped glass tube.

(2) Six's thermometer contains the liquids _____ and _____.

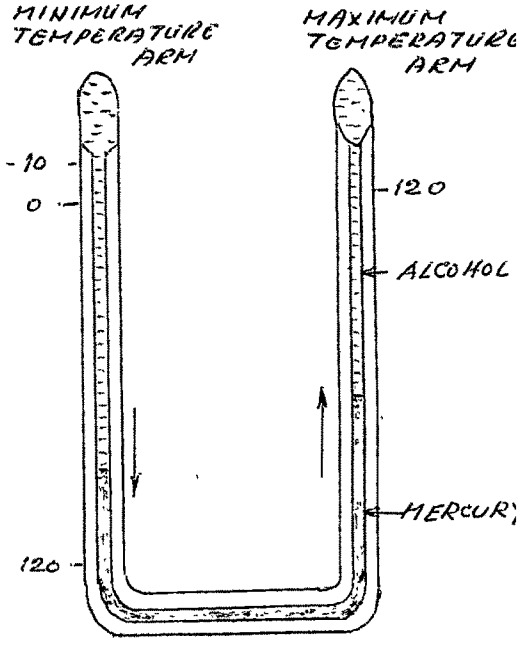
(3) It has two arms, one for recording the _____ temperature and the other for recording the _____ temperature of the day.

(4) There is a vacuum in the arm carrying the _____ (maximum/minimum) temperature scale.

(5) The maximum temperature scale starts from the _____ (bottom/top) while the minimum temperature scale starts from the _____.

Correct answers are given on Page 43-A.

Observe the figure carefully. When the temperature rises, the mercury and alcohol expand and move upwards in the maximum temperature arm. The mercury pushes the index upwards till the maximum temperature is reached. When the maximum temperature is reached, the index remains steady. Even if the mercury moves downwards, the index does not move downwards because the hair spring prevents it from moving. The index remains steady showing the maximum temperature of the day. The scale of the maximum temperature arm starts from the bottom. So higher the position of the index, higher will be the temperature. When the temperature rises, the mercury level in the minimum temperature arm _____.



	Page
Falls	44-B
rises	40-A

EXERCISE No. 12

Tickmark (_/) in the answer sheet the two special parts of the maximum and minimum thermometers not found in common thermometers.

(a) Scale ( )
(b) Glass tube ( )
(c) Hair spring ( )
(d) Bulb ( )
(e) Index ( )
(f) Mercury ( )

Answers are given on Page No. 39-B.

Correct answers for the EXERCISE No. 15

(1) Six's thermometer consists of a U shaped glass tube.

(2) Six's thermometer contains the liquid mercury and alcohol.

(3) It has two arms, one for recording the maximum temperature and the other for recording the minimum temperature.

(4) There is vacuum in the arm carrying the maximum temperature scale.

(5) The maximum temperature scale starts from the bottom, while the minimum scale starts from the top.

If all your answers are correct, go to Page 42-A.

If some of your answers are wrong, go to Page 41.

Your answer was :

In the minimum temperature arm of the Six's thermometer the index moves upwards. Yes, you are right.

In the Six's thermometer, the indices are above the levels of mercury and so both the indices are pushed upwards by the mercury. The index I_1 for the maximum temperature moves upwards when the mercury expands. The index I_2 for minimum temperature moves upwards when the mercury contracts. The temperature scale in the minimum arm starts from the top.

Study the material on Page 44-A.

EXERCISE No. 16

Answer the following :

(1) Six's thermometer is a _____ shaped thermometer.

(2) How many indices are there in Six's thermometer? _____

(3) What are the liquids used in Six's thermometer? _____

(4) In Six's thermometer, both the indices are pushed by _____ (alcohol/mercury).

(5) In Six's thermometer, both the indices move _____ (upwards/downwards).

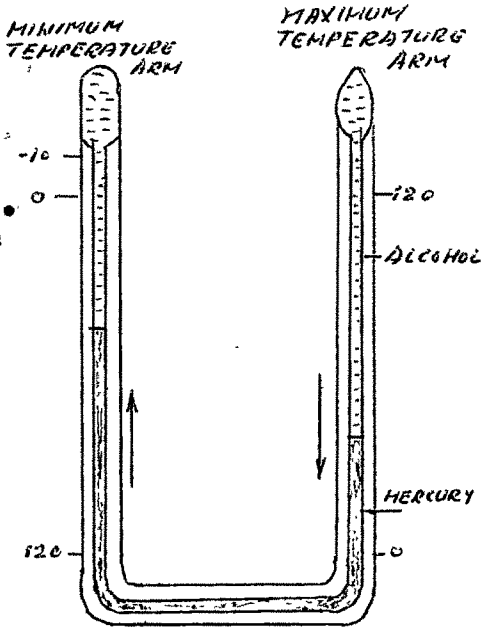
(6) In Six's thermometer, the maximum temperature scale starts from the _____ (bottom/top), while the minimum temperature scale starts from the _____.

Correct answers are given on Page 45-A.

Your answer was :

When the temperature rises mercury in the minimum temperature arm falls. Yes, you are right.

When the temperature falls, the mercury and alcohol contract and their levels fall in the maximum temperature arm, but mercury level rises in the minimum temperature arm. When the level of mercury rises, the index is pushed upwards till the minimum temperature is reached. When the minimum temperature is reached, the index remains steady indicating the minimum temperature of the day. The hair spring prevents the index from moving downwards. The scale in the minimum temperature arm starts from the top. So higher the position of the index, lower will be the temperature.



When the temperature falls, the index in the minimum temperature arm moves _____.

	Page
upwards	43-B
downwards	35-B

Correct answers for the EXERCISE No. 16

(1) Six's thermometer is a U shaped thermometer.

(2) Two or 2 indices are there in Six's thermometer.

(3) Mercury and alcohol are used in Six's thermometer.

(4) In Six's thermometer, both the indices are pushed by the mercury.

(5) In Six's thermometer, both the indices move upwards.

(6) In Six's thermometer, the maximum temperature scale starts from the bottom, while the minimum temperature scale starts from the top.

If all your answers are correct, go to Page 48-A.

If some of your answers are wrong, go to Page 43-B.

The bulb of the clinical thermometer is placed under the tongue or in the arm pit of the patient whose body temperature is to be recorded. The mercury expands due to the body temperature and flows upwards in the stem. Above the bulb is a bent called constriction.

When the thermometer is removed from the body of the patient, the mercury contracts. But the downward movement of the mercury is prevented by the constriction.

So the mercury which is above the constriction remains steady and its level shows the body temperature of the patient.

In the clinical thermometer, the mercury is kept steady by the .....

Page

constriction 49-A

bulb 46-A

Your answer was :

In the clinical thermometer the mercury is kept steady by the bulb. Why do you think so?

Well, bulb is present in all thermometers. But the level of mercury in them does not remain steady. The bulb is just to contain mercury. It is some other special part of the clinical thermometer that keeps the mercury in a steady position.

Study the material on Page 45-B

Your answer was :

The clinical thermometer should be washed with boiling water.

You have forgotten one important point.

The temperature of boiling water is 212°F while the clinical thermometer is graduated upto 110°F only. So, if the clinical thermometer is washed with boiling water, mercury tries to expand to that high temperature and in doing so it breaks the glass. This will damage the thermometer. Therefore the thermometer should not be washed with water at higher temperatures, say 100°C.

Study the material on Page 47-A.

If the clinical thermometer is washed with boiling water (212°F), the mercury in the stem tries to expand upto that temperature. But the stem is graduated upto 110°F only and so the expanding mercury forces itself through the glass and this breaks the thermometer.

Clinical thermometer should be washed with .....

	Page
Cold water	50-B
boiling water	46-B

Correct answers for the EXERCISE No. 19

Parts of the clinical thermometer :

(i) Part A is the stem.

(ii) Part B is the constriction.

(iii) Part C is the mercury.

(iv) Part D is the bulb.

(v) Arrow indicates the normal body temperature.

(vi) N is at the temperature of 98.4°F.

If all the answers are correct, go to Page 53.

If some of your answers are wrong, go to Page 51.

Clinical thermometer records the temperature of human body while Six's thermometer records the maximum and minimum temperatures of the day.

In the figure given below the parts of the clinical thermometer are marked by different letters.

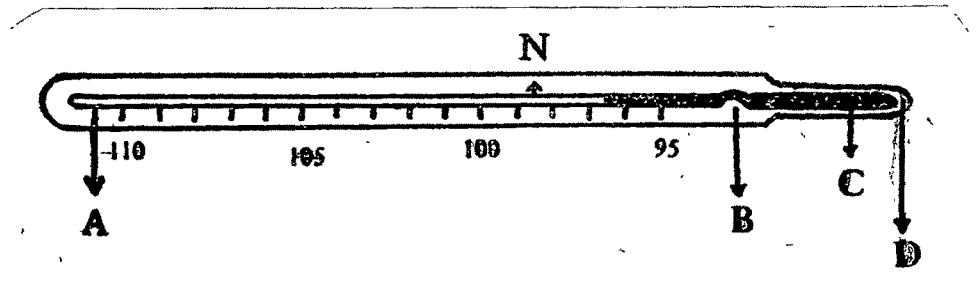
Part A : Shows the stem of the thermometer.

Part B : Shows the bent called constriction.

Part C : Shows mercury used in the thermometer.

Part D : Shows the bulb which is filled with mercury.

Part N : The arrow at N (98.4°F) shows the normal body temperature.



Observe the figure and try to recognize the names of the parts.

Now go to B part of this Page.

EXERCISE No. 17

Given below are the parts of clinical thermometer.

Observe the figure given above carefully and indicate which part is marked by which letter in the figure.

(1) Bulb is marked by the letter _____

(2) Mercury is marked by the letter _____

(3) Constriction is marked by the letter _____

(4) Normal body temperature is marked by the letter _____

(5) The value marked at N is _____°F.

(6) The stem is marked by the letter _____.

Correct answers are given on Page 52-A.

Your answer was :

The part that keeps the mercury steady is the constriction.
Yes, you are right.

Constriction allows the mercury to move in the upward direction only. So the mercury remains steady showing the body temperature of the patient.

Then, how to bring the mercury downwards?

So it is necessary to shake the thermometer in order to bring the mercury downwards into the bulb.

Go to Page 47-A.

EXERCISE No. 18

Complete the following sentences by selecting the correct words from the list given below :

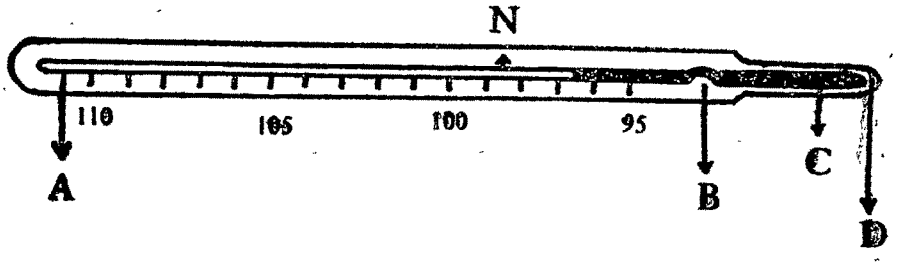
WORDS : magnet, index, bulb, hair spring, arrow, constriction, vacuum.

(a) Thermometers burst at higher temperatures if there is no _____ above the mercury in the thermometer.
(b) Steel index is prevented from moving by the _____.
(c) The back flow of the mercury in clinical thermometer is prevented by the _____.
(d) The index is reset using a small _____.
(e) In the Six's thermometer the temperature of the day is indicated by the _____.
(f) To measure the temperature of water, the _____ of the thermometer is immersed in it.
(g) Normal body tempeature of 98.4°F is shown in the clinical thermometer by the _____.

Correct answers are given on Page 52-B.

EXERCISE No. 19

Below is given the diagram of the clinical thermometer. Some parts of it are marked by A, B, C, D and N. Write the names of the parts in the blanks provided.



(i) Part A is the .....

(ii) Part B is the .....

(iii) Part C is the .....

(iv) Part D is the .....

(v) Arrow indicates the .....

(vi) N is at the temperature of _____°F.

Correct answers are given on Page 47-B.

Your answer was :

The clinical thermometer should be washed with cold water.

Yes, you are right.

If the thermometer is washed with boiling water, the expansion of the mercury will be too much, and this will break the thermometer.

Go to Page 49-B.

(a) The bulb of the common thermometer contains the liquid mercury.

(b) The bulb is at the lower end of the thermometer.

(c) While measuring the temperatures, the bulb of the thermometer should be kept in contact with the object.

(d) Thermometer contains a vacuum which allows the mercury to expand. If there is no vacuum, the thermometer bursts at higher temperatures.

(a) Indices are present in the maximum or minimum or Six's thermometer.

(b) Index is used in order to record the maximum or minimum temperature of the day.

(c) Hair spring is attached to the index in order to keep it in its steady position.

(d) Indices are adjusted using the magnet because they are made of steel.

(a) Shake the clinical thermometer before use in order to bring the mercury back to the bulb.

(b) The clinical thermometer breaks when it is washed with boiling water.

(c) In the clinical thermometer there is a bent called constriction in between the stem and the bulb. It allows the mercury to move in the upward direction only.

(d) In the clinical thermometer, the normal body temperature of 98.4°F is indicated by an arrow. When a patient has fever, the level of mercury stands above the arrow.

NOTE :

If you are coming from Page 47-B, go back to Page 50-A.

If you are coming from Page 52-B, go back to Page 49-B.

Correct answers for the EXERCISE No. 17

Clinical thermometer and its parts.

(1) Bulb is marked by the letter D.
(2) Mercury is marked by the letter C.
(3) Constriction is marked by the letter B.
(4) Normal body temperature is marked by the letter N.
(5) The value marked at N is 98.4°F.
(6) Stem is marked by the letter A.

If all your answers are correct, go to Page 45-B.

If some of your answers are wrong, go to Page 48-A.

Correct answers for the EXERCISE No. 18

(a) The thermometer would burst at higher temperatures if there is no vacuum above the mercury in the thermometer.

(b) The steel index is prevented from moving by the hair spring.

(c) The back flow of mercury is prevented by constriction.

(d) The steel index is reset using a small magnet.

(e) In the Six's thermometer the temperature of the day is indicated by the Index.

(f) To measure the temperature of water, the bulb of the thermometer is immersed in it.

(g) Normal body temperature (98.4°F) is shown by the arrow.

If all your answers are correct, go to Page 50-A.

If some of your answers are wrong, go to Page 51.

Some interesting things about thermometers :

* Galileo at the end of 16th century prepared a water thermometer (the first thermometer).
* Amonton discovered that water always boiled at the same temperature at sea level.
* Fahrenheit discovered mercury to be the most suitable thermometric liquid. He constructed a mercury thermometer called Fahrenheit thermometer.
* Celsius constructed the Centigrade thermometer.

Answer the following :

(a) The use of mercury was discovered by .....

(b) The first thermometer was constructed by .....

(c) Centigrade thermometer was constructed by .....

(d) Steady boiling point of water was discovered by .....

Answers

(a) Fahrenheit
(b) Galileo
(c) Celsius
(d) Amonton

Answers are given on the left side of this page.

NOW THE PROGRAMME IS OVER

A PROGRAMMED TEXT ON THERMOMETERS

SKIP-PROGRAMME FORM

ABOUT THIS PROGRAMME :

On reading this programme, you will know many interesting things about thermometers. Thermometers are the instruments used to measure the heat levels. You have to know something about thermometers because we use them in hospitals, laboratories, houses and so on.

HOW TO READ THIS BOOK :

(1) This book contains small steps called frames. Read each frame carefully.

(2) In some frames there will be a gap or gaps. You have to fill in the blank(s) with suitable word or words.

(3) In some frames there will be a blank followed by two alternatives in the brackets. You have to select the suitable answer.

(4) In some frames you have to tick mark the number of the correct answer or answers.

(5) You have to read each frame; think of the correct answer and then write it against the serial number on the separate answer sheet given to you. If serial number of the answers are given to any question in the answer sheet you may put tick mark (✓) on the correct one and do not write the complete answer. Do not write anything in this book.

(6) The correct answers are given in the same frame on the left hand side of the margin. Keep the answers covered with card given to you.

(7) After writing your answers, move the card and check whether you are right.

(8) If your answer is correct, then go to the next frame. But, if your answer is not correct, do not worry. Read the frame and try it again.

(9) Some frames do not contain the correct answers. In that case, go to the next frame. There you will be told the correct answer. Check your answer and go to the frame as indicated. To help you, such instruction frames are bordered with colour ink.

COVER the correct answers

READ the frame

UNDERSTAND it

WRITE the answer

CHECK your answer

PROCEED FURTHER

.....

1. When the heat level of a substance is low, we say that the temperature is low.

level

Temperature indicates the heat _____ of a substance.

---

2. (a) When a substance is heated, its heat level _____ (rises/falls).

(a) rises

(b) That is, when a substance is heated, its temperature _____ (falls/rises).

---

3. If your answer is falls; go to frame No. 4
If your answer is rises; go to frame No. 9

---

4. A beaker filled with water is kept on fire.

(a) Yes
(b) rises

(a) Does the water get heated? ____ (Yes/No)
(b) Its heat level _____ (rises/falls).

---

5. A pot of milk is kept in ice.

(a) cooled
(b) falls

(a) It gets _____ (heated/cooled)
(b) Its heat level _____ (rises/falls).

---

6. On heating, the heat level of water rises.

On cooling the heat level of milk falls.

Can the heat level be changed by heating or cooling? _____ (Yes/No)

Yes

---

7. Ice water and boiling water differ in their heat levels. In other words, ice water and boiling water differ in their temperatures.

Does the temperature indicate the heat level of a substance? _____ (Yes/No)

Yes

---

8. (a) Temperature indicates the heat _____ of a substance.

(a) level

(b) When the heat level is high, we say that the temperature is _____ (high/low).

(b) high

---

9. The heat level of a substance is scientifically known as the temperature of that substance.

A substance at low temperature is said to be cold.

A substance at high temperature is said to be _____ (cold/hot).

hot

---

10. (a) If the temperature of a substance is _____ (high/low) we say that it is hot.

(a) high

(b) If the _____ of a substance is low, we say that it is cold.

(b) temperature

---

11. What are the common words used to indicate the following?

(a) cold

(a) low temperature : _____

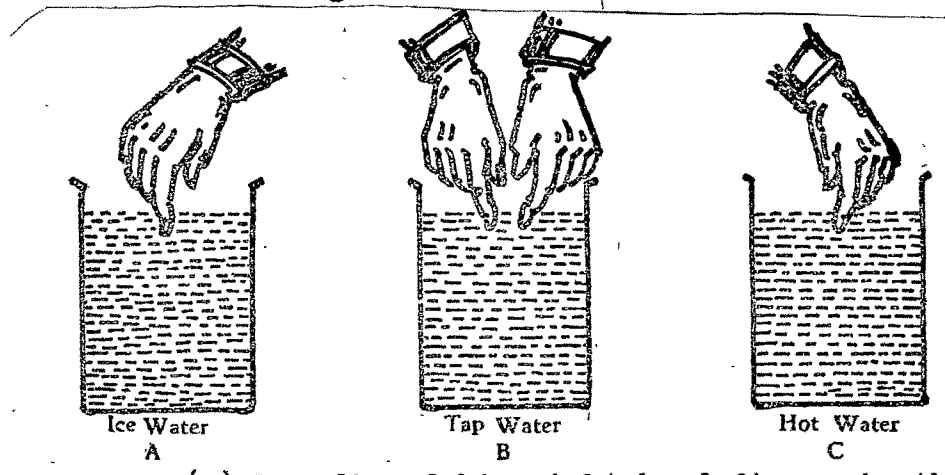
(b) hot

(b) high temperature : _____

---

12. The following is one way of FEELING whether a substance is cold or hot.

Observe the figure carefully and answer the following :



(a) Ram dipped his right hand finger in the beaker A. It was felt _____ (hot/cold).

(a) cold

(b) Ram dipped his left hand finger in the beaker C. It was felt _____ (hot/cold).

(b) hot

---

13. Then he dipped both the fingers in the beaker B. To the right hand, the water in the beaker B was felt hot and to the left hand it was felt cold.

Can the exact temperature of water be known by touching it? _____ (Yes/No)

---

14. If your answer is Yes, go to frame No. 15.
If your answer is No, go to frame No. 17.

---

15. Tick mark _/ the number of correct answer.

Ram's experience regarding the temperature of water in beaker B

(i) remained the same. ( )

(ii) _/ (ii) differed from hand to hand. ( )

---

16. By touching the tap water, Ram ..... (could/could not) know its exact temperature.

could not

---

17. Can Ram know the exact temperature of water in beaker B by using a thermometer? ___(Yes/No)

---

18. If your answer is Yes, go to frame No. 20.

If your answer is No, go to frame No. 19.

---

19. Heat level or temperature of a substance can be measured scientifically using a thermometer.

The instrument used measure the _____ a substance is called thermometer.

temperature

---

20. To measure the temperature of a substance we use an instrument called _____.

thermometer

---

21. (a) When a substance is heated, its temperature _____ (rises/falls).

(b) When a substance is cooled, its temperature _____.

(a) rises
(b) falls

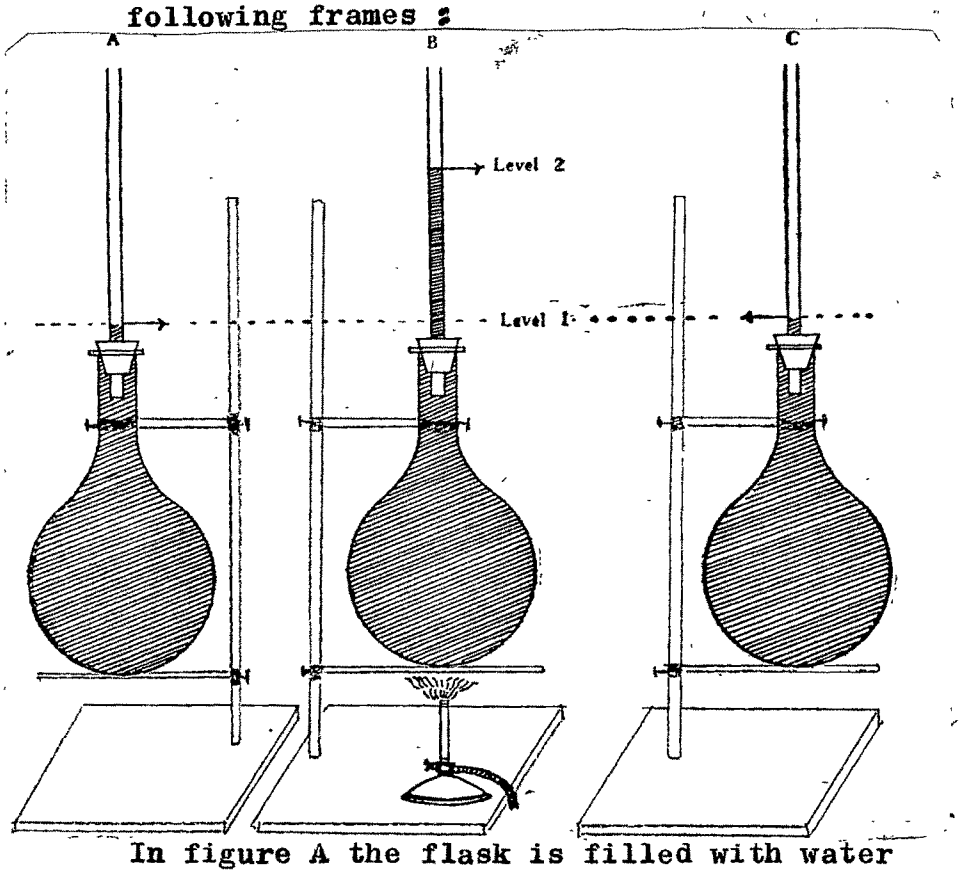
---

22. On heating or cooling a substance, its _____ changes.

temperature

---

23. Observe the figure carefully and answer the following frames :



In figure A the flask is filled with water upto the Level 1.

The flask is heated with a burner as shown in the figure B.

Due to heating, the level of water _____

rises (rises/falls) from Level 1 to Level 2.

---

24. Burner is removed and the flask is cooled. On cooling, the level _____ (rises/falls)

falls as shown in figure C.

---

25. Tickmark _/_ the number of correct answer in the answer sheet.

Rise in the level of water in figure B is due to

(a) cooling ( )
(b) adding some more water ( )
(c) _/_ (c) heating ( )

---

26. When the temperature of a substance rises, it _____ (expands/contracts).

---

27. If your answer is expands, go to frame No. 30.
If your answer is contracts, go to frame No. 28.

---

28. The level of milk rises when it is heated.
But on cooling, its level _____ (rises/falls).

falls

---

29. When any liquid (milk or water) is heated, its level rises and it occupies _____ (more/less) space.

more

---

30. Occupying more space on _____ (heating/cooling) is called expansion.

heating

---

31. When water is cooled, its level falls and it occupies _____ space.

less

---

32. Occupying less space on cooling is called _____ (expansion/contraction).

contraction

---

33. Tickmark _/ the correct answer in the answer sheet.

Expansion means

(i) occupying more space on cooling: ( )
(ii) occupying less space on cooling: ( )
(iii) occupying more space on heating: ( )
(iv) occupying less space on heating: ( )

(iii) _/

---

34. When the temperature of a substance falls, it _____ (contracts/expands).

---

35. If your answer is contracts, go to frame No.36.

If your answer is expands, go to frame No.28.

---

36. Below are given some words related to expansion and contraction. Tickmark (_/) only those related to contraction in the answersheet.

(i) cooling(_/)

(ii) Fall in temperature

(iii) Occupying less space

(i)	Cooling	( )
(ii)	Fall in the temperature	( )
(iii)	Occupying less space	( )
(iv)	Rise in the temperature	( )
(v)	Occupying more space	( )
(vi)	Heating	( )

---

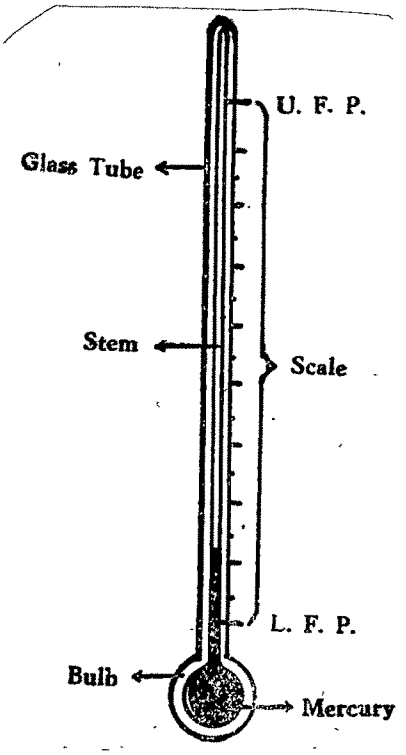
37. Thermometer is constructed on the principle that liquids expand with _____ (rise/fall) in temperature and contract with fall in _____.

rise

temperature

---

38. Below is given the figure of a thermometer. Study the figure carefully and recognize the various parts of it.



(a) The lower end of the thermometer which is filled with mercury is called the _____.

(b) Thermometer has a scale to measure the _____ of a substance.

(c) The scale is marked on the stem. In the figure above, some divisions are marked on the stem of the thermometer. These divisions make a _____ which helps to measure temperature.

(a) bulb
(b) temperature
(c) scale

---

39. (a) The thermometer is filled with _____.

Tickmark (_/) the number of correct answer in the answer sheet.

(b) Mercury is filled in the

(i) entire stem ( )
(ii) part of the stem ( )

(a) mercury
(b) (ii) _/

39A U.F.P. is at the _____(lower/upper) end of the temperature scale.

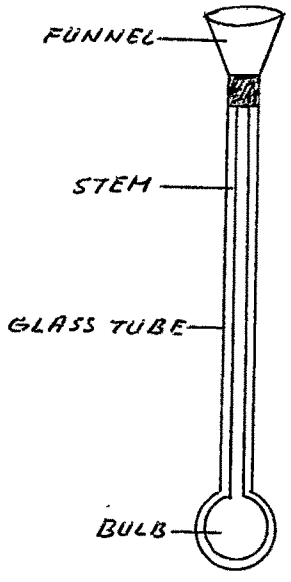
upper

40. U.F.P. is the upper fixed point of the scale. The lower fixed point of the scaled is marked as _____.

L.F.P.

---

41. Thermometer is constructed on the principle of expansion and contraction of liquids.
Let us see the material used in the construction of the common thermometer.
Study the figure carefully and answer the following frames



A tube with narrow and uniform bore which is made up of _____ (glass/metal) is taken.

glass

---

42. Mercury can be poured through the ____(bulb/funnel)

---

43. If your answer is bulb, go to frame No. 44.
If your answer is funnel, go to frame No. 47.

---

44. (a) The lower end of the glass tube is blown into _____.
(b) The funnel is at the _____(lower/upper) end of the tube.

(a) bulb
(b) upper

45. The upper end is used to pour the _____ into the glass tube.

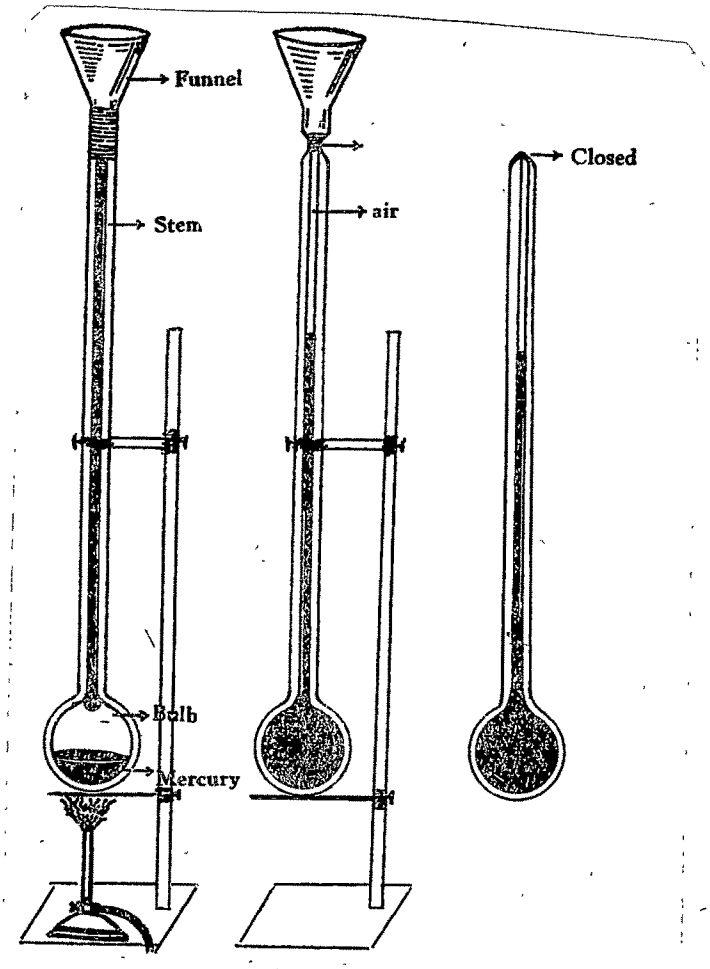
mercury

46. The upper end is in the shape of a _____ through which mercury can be poured.

funnel

47. The following frames describe the process of filling the bulb and the stem with mercury and sealing its upper end.

Study the figure carefully and answer the following frames.



(a) The mercury is poured through the _____ (bulb/funnel).

(a) funnel

(b) After pouring some mercury, the bulb is _____(heated/cooled) with the burner.

(b) heated

48. The glass tube contains air inside it. On heating, the mercury expands and drives the _____ out.

air

---

49. After sealing the upper end, we have a mercury thermometer in which there is _____ (air/no air).

---

50. If your answer is air, go to frame No. 51.
If your answer is no air, go to frame No. 56.

---

51. Burner is removed and the glass tube is allowed to cool down. The mercury in the glass tube becomes _____ (hot/cold).

cold

---

52. Heating and cooling are repeated till the entire bulb and a part of the stem are filled with _____.

mercury

---

53. The mercury is heated in order to drive all the _____ out.

air

---

54. After driving all the air out, the upper end is _____ (closed/kept open).

closed

---

55. Tickmark _/ the number of correct answer in the answer sheet.

Mercury is strongly heated in order to

(i) seal the thermometer ( )

(ii) drive the air out ( )

(iii) make the mercury expand ( )

(ii) drive the air out

---

56. The air above the mercury level is driven out. Thus a vacuum is created. This vacuum is _____ (above/below) the mercury level.

above

---

57. After sealing the upper end, there is _____ (air/vacuum) above the mercury level.

vacuum

58. Vacuum allows the mercury to _____(expand/contract).

---

59. If your answer is expand, go to frame No. 66.
If your answer is contract, go to frame No. 60.

---

60. After sealing the upper end there is no air (= vacuum) above the level of _____.

mercury

---

61. There is _____ (air/vacuum) above the mercury level.

vacuum

---

62. The mercury expands when there is a _____ (rise/fall) in temperature.

rise

---

63. The thermometer would burst if there is no space for the _____(mercury/air) to expand.

mercury

---

64. Thermometer would burst at higher temperatures if there is no _____ (air/mercury/vacuum).

vacuum

---

65. Vacuum allows the mercury to _____ (expand/contract).

expand

---

66. In thermometers we should use a shining liquid which does not wet the glass. It should be sensitive to heat also. Mercury has all these characteristics.

Can we use any liquid other than mercury in the common thermometers? _____(Yes/No)

---

67. If your answer is Yes, go to frame No. 68.

If your answer is No, go to frame No. 72.

---

68. The level of a shining liquid can be seen clearly through the glass. So shining liquids are highly suitable to be used in the thermometers.

Mercury is used in the thermometers because it is a _____ liquid.

shining

---

69. Liquids which wet the glass do not show exact readings. Mercury shows the exact readings because it _____ (wets/does not wet) the glass.

does not wet

---

70. The liquid used in the thermometers should be a good conductor of heat (i.e. it should take up heat readily).

Mercury is used in the thermometers because it is a good _____ of heat.

conductor

---

71. Bad conductors do not take up heat readily.

Can we find out small changes in temperature using a bad conductor of heat (i.e. one which does not take up heat readily)? ____(Yes/No)

No

---

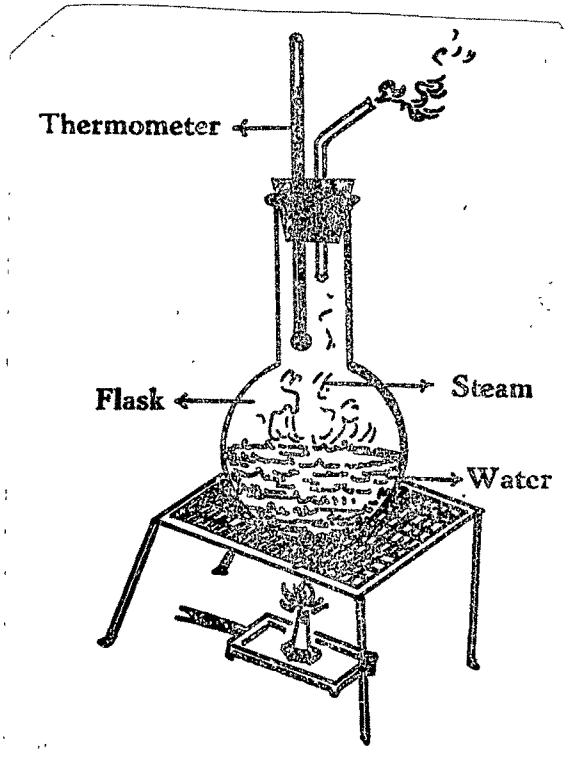
72. Of the following, tickmark (_/) number of those statements which describe why mercury is used in the thermometers :

(a) Mercury cannot be seen through the glass ( )
(b) Mercury is sensitive to even small changes in temperature. ( )
(c) Mercury does not wet the glass. ( )
(d) Mercury expands and contracts very slowly. ( )
(e) Mercury can be seen through the glass. ( )
(f) Mercury is a shining solid. ( )
(g) Mercury is a shining liquid. ( )
(h) Mercury sticks to the glass. ( )

(b) _/
(c) _/
(e) _/
(g) _/

---

73. On the stem of the thermometer are marked the two important points of the temperature scale, namely the U.F.P. and the L.F.P.
In the following frames the procedure of marking the U.F.P. is described.
Observe the figure carefully and answer the following frames :



MARKING THE U. F. P.

(a) The thermometer is kept _____ (above/below) the level of boiling water.

(b) Due to the high temperature of boiling water, the mercury level in the thermometer (rises/falls).

(a) above
(b) rises

---

74. (a) After reaching a point (at the boiling point of water), the level of _____ in the thermometer does not rise further.

(b) This point is marked as the _____ (upper/lower) fixed point.

(a) mercury
(b) upper

75. Does the U.F.P. indicate the boiling point of water? _____ (Yes/No)

---

76. If your answer is No, go to frame No. 77.
If your answer is Yes, go to frame No. 82.

---

77. The temperature at which water boils and turns into steam is called the boiling point of _____ (water/mercury).

water

---

78. The mercury remains steady at the _____ point of water.

boiling

---

79. Upper fixed point (U.F.P.) of the temperature scale is marked at that point where the mercury level is _____ (steady/rising).

steady

---

80. The boiling point of water at which the mercury level is steady is marked as the _____ _____ _____ of the scale.

Upper Fixed Point or U.F.P.

---

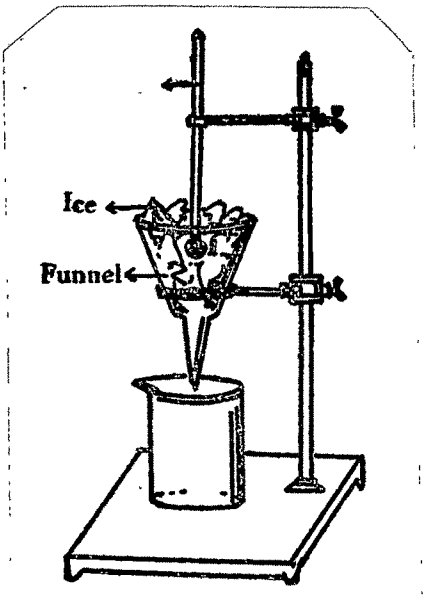
81. Does the U.F.P. indicate the boiling point of water? ____ (Yes/No)

Yes

---

82. We have seen that the U.F.P. is marked at the boiling point of water. In the following frames the process of marking the Lower Fixed Point (L.F.P.) of the temperature scale is described.

Observe the figure carefully and answer the following frames :



MARKING THE L. F. P.

Bulb of the thermometer is put in a funnel filled with melting _____.

ice

---

83. Due to the low temperature of melting ice, the level of the mercury _____ (falls/rises).

falls

---

84. (a) After reaching a point (at the melting point of ice) the level of _____ does not fall further.

(b) This point is marked as the _____ (upper/lower) fixed point.

(a) mercury
(b) lower

---

85. Does the L.F.P. indicate the melting point of ice? _____ (Yes/No)

---

86. If your answer is Yes, go to frame No. 92.

If your answer is No, go to frame No. 87.

---

87. The temperature at which ice melts is called the melting point of _____ (ice/water/mercury).

ice

---

88. Mercury remains steady at the _____ point of ice.

melting

---

89. Lower Fixed Point (L.F.P.) is marked at the point where mercury level is _____ (steady/falling).

steady

---

90. The mercury level remains steady at the melting point of ice. This is marked as the _____ _____ _____ of the scale.

Lower Fixed Point or L.F.P.

---

91. Tickmark _/ the number of correct answer.

U.F.P. indicates the

(i) melting point of ice ( )

(ii) _/ (ii) boiling point of water ( )

---

92. Tickmark _/ the number of correct answer in the answer sheet.

The fixed point marked at the melting point is the

(i) L.F.P. ( )

L.F.P. _/ (ii) U.F.P. ( )

---

93. There are many divisions between the L.F.P. and U.F.P. These divisions are marked with numbers. The process of marking the divisions and numbers between the U.F.P. and ..... is called graduating the thermometer.

L.F.P.

---

94. Tickmark _/ the number of correct answer.

By making the divisions and numbers on the thermometer, we get the

(i) U.F.P. and L.F.P. ( )

(ii) temperature scale ( )

---

95. If your answer is U.F.P. and L.F.P., go to frame No. 99.

If your answer is temperature scale, go to frame No. 96.

---

96. Marking the divisions and numbers of the temperature scale is called _____ the thermometer.

graduating

---

97. Graduating the thermometer is the process of marking the _____ and _____ of the temperature scale.

divisions, numbers (any order)

---

98. The divisions and numbers are made after making the _____ and _____ fixed points.

upper, lower (any order)

---

99. By marking the divisions and numbers, we get the _____ (U.F.P. and L.F.P./ temperature scale).

temperature scale

---

100. After graduating (marking the divisions and numbers) we get either the Centigrade (C) scale or Fahrenheit (F) scales of temperature. C and F scales differ in 3 ways :

(i) the value of L.F.P.

(ii) the value of U.F.P.

(iii) the number of divisions between U.F.P. and L.F.P.

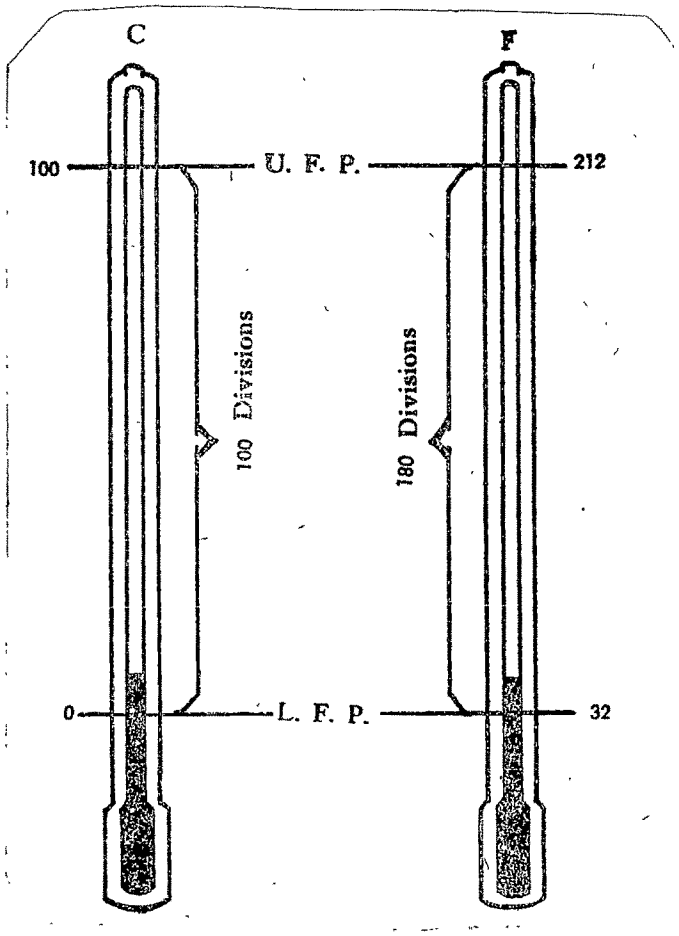
Do C and F scales contain the same number of divisions between U.F.P. and L.F.P.? ___(Yes/No)

No

---

101. Now we shall study the differences between the C and F scales.

Observe the figure carefully and answer the following frames :



U.F.P.

(a) 100 (a) U.F.P. marked on the C scale is _____°C.

(b) 212 (b) U.F.P. marked on the F scale is _____°F.

---

102. L.F.P.

(a) 0 (a) L.F.P. marked on the C scale is _____°C.

(b) 32 (b) L.F.P. marked on the F scale is _____°F.

---

103. Number of divisions between the U.F.P. and L.F.P.

(a) 100 (a) How many divisions are there in a C scale?___

(b) 180 (b) How many divisions are there in a F scale?___

(c) F (c) 32°F is the L.F.P. of ____(C/F) scale.

---

104. 32°F is marked at the _____ (U.F.P./L.F.P.) of the F scale.

L.F.P.

---

105. Using a Fahrenheit scale, can we measure temperature very much higher than 100°C?
_____ (Yes/No)

---

106. If your answer is Yes, go to frame No. 100.

If your answer is No, go to frame No. 107.

---

107. What do the following abbreviations and symbols stand for?

(i)	Lower Fixed Point	(i) L.F.P.	_____
(ii)	Degree	(ii) °	_____
(iii)	Degree Centigrade	(iii) °C	_____
(iv)	Upper Fixed Point	(iv) U.F.P.	_____
(v)	Fahrenheit	(v) F	_____
(vi)	Centigrade	(vi) C	_____

---

108. Compare the Centigrade and Fahrenheit scales.

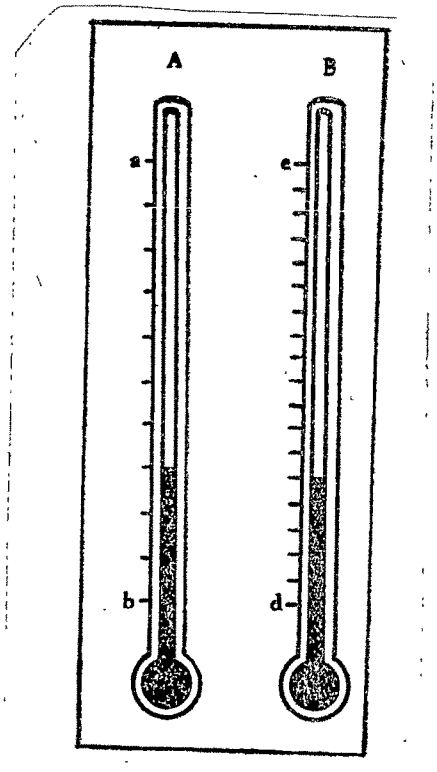
		Centigrade	Fahrenheit
(a) 100°C, 212°F	(a) U.F.P. is	_____	_____
(b) 0°C, 32°F	(b) L.F.P. is	_____	_____
(c) 100, 180	(c) No. of divisions are.....	_____	_____

---

109. Observe the figure carefully.
The parts of the two thermometers with their U.F.P. and L.F.P. are shown. You have to write the values of those points in the blanks given below.

Figure A shows the scale that contains 100 divisions.

Figure B shows the scale that contains 180 divisions.



Fill in the blanks :

A. 1. Centigrade
2. Faherenheit

A. (1) The figure A shows the _____ (Centigrade/Fahrenheit)
(2) The figure B shows the _____ (Centigrade/Fahrenheit)

B. 1. 100°C
2. 0°C
3. 212°F
4. 32°F

B. (1) Value at 'a' is _____ (100°C/212°F)
(2) Value at 'b' is _____ (0°C/ 32°F)
(3) Value at 'c' is _____. " "
(4) Value at 'd' is _____.

110. Temperatures are written as 23°C, 71°F, 4.8°C, 5.6°F, etc.
Two decimal eight degrees Fahrenheit is written as _____ (2.8°F/2.8°C).

2.8°F

---

111. Temperatures below the zero degree are expressed with a minus sign, for example, -20°C, -42°F, etc.
Tickmark number of the correct answer.
Minus seven degrees Fahrenheit (-7°F) is a temperature which is
(i) above the 0°F ( )
(ii) below the 0°C ( )
(iii) below the 0°F ( )

---

112. If your answer is <u>above the 0°F</u>, go to frame No.11
If your answer is <u>below the 0°C</u>, go to frame No.11
If your answer is <u>below the 0°F</u>, go to frame No.12

---

113. Twentytwo degrees Centigrade is written as _____ (22°C/22°F).

22°C

---

114. 61°C is the temperature which is 61 degrees above the zero degree of _____(Fahrenheit/Centigrade)

Centigrade

---

115. If the temperature is expressed in Fahrenheit scale, the symbol _____ (C/F) is to be used.

F

---

116. Temperature below the 0° are expressed with a minus sign.
-61°C is a temperature which is _____(above/below) the 0°C.

below

---

117. -47°F is a temperature which is 47 degrees _____ (above/below) the 0°F.

below

---

118. 17 degrees below the 0°C is written as _____ (17°C/-17°C).

-17°C

---

119. -38°F is a temperature, 38 degrees below the _____ (0°C/0°F).

0°F

---

120. Tickmark _/ the number of correct answer.
-23°F is a temperature which is
(i) above the 0°F ( )
(ii) below the 0°F ( )
(iii) below the 0°C ( )

(ii) below the 0°F

---

121. (a) To find the temperature of hot water, the bulb of the thermometer is immersed in hot _____.

(b) Due to the high temperature of hot water, there is a _____(rise/fall) in the mercury level.

(c) The main scale divisions to which the level of _____ rises is noted.

(d) The number marked on that particular division where mercury level remains steady gives the _____ of the hot water.

(a) water
(b) rise
(c) mercury
(d) temperature

---

122. When the mercury level in the thermometer is high, we say that the temperature of water is comparatively _____ (high/low).

---

123. If your answer is <u>high</u>, go to frame No. 127.
If your answer is <u>low</u>, go to frame No. 124.

---

124. The temperature of water at 50°C is more than the temperature of water at _____ (60°C/40°C).

40°C

---

125. The bulb of a thermometer is first kept in water at 50°C. Then it is kept in water at 45°C. The level of mercury at 50°C is comparatively _____ (higher/lower) than that at 45°C.

higher

---

126. When the mercury level is higher, we can say that the temperature is comparatively _____ (high/low).

high

---

127. Below are given the steps followed in using a thermometer. But it is not given in the proper order. Write the number of correct order of the steps in the answer sheet.

1. Final recording of temperature i.e. 51°C. ( )
2. Mercury level of thermometer changes. ( )
3. Bulb of the thermometer is put in the liquid. ( )
4. Main scale division near the mercury level is noted. ( )

(4)
(2)
(1)
(3)

---

128. Common thermometers are used to measure the temperature of a substance. To measure the atmospheric temperature of a day, that is, the maximum and minimum temperatures of a day, or the body temperature of a patient, we need some special thermometers.

The minimum temperature of a day can be measured using a _____ (common/special) thermometer.

special

---

129. <u>Thermometers which record the atmospheric temperatures of a day</u>

(i) Maximum thermometer
(ii) Minimum thermometer
(iii) Six's thermometer

<u>Thermometer to measure our body temperature</u> is

(i) Clinical thermometer

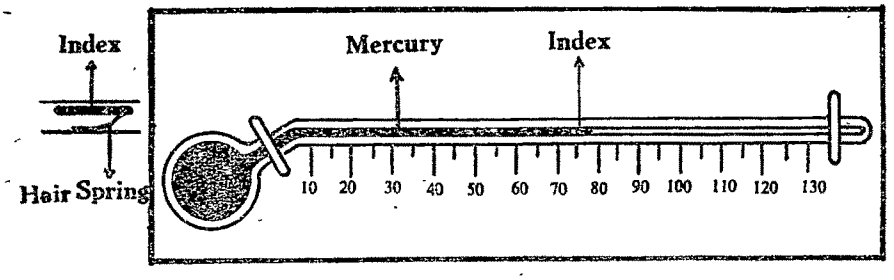
Maximum thermometer records the _____ (maximum/minimum) temperature of the day.

maximum

---

130. Maximum thermometer records the maximum temperature of the day. Observe the figures of the maximum thermometer carefully and recognize the parts before you proceed further.

THE MAXIMUM THERMOMETER



(a) The bulb and a part of the stem of the maximum thermometer are filled with _____.

(a) mercury

(b) The steel index is above the level of _____.

(b) mercury

---

131. The steel index is shown separately in its enlarged form. It consists of two important parts namely ..... and .....

index, hair spring

---

132. (a) The scale is marked from _____°F to _____°F.

(b) The highest value of the scale (130°F) shown in the figure is _____(near/away from) the bulb.

(a) 10, 130

(b) away from

---

133. When the temperature rises, mercury expands and pushes the index _____ (upwards/downwards).

---

134. If your answer is upwards, go to frame No. 139.

If your answer is downwards, go to frame No. 135.

---

index	135.	Above the level of mercury is a steel _____.
	136.	When the temperature of the day rises, the mercury _____ (expands/contracts) and moves upwards.
expands		
	137.	The index is _____ (above/below) the level of mercury.
above		
	138.	So the rising mercury pushes the index _____ (upwards/downwards).
upwards		
	139.	The upward movement continues till the _____ (maximum/minimum) temperature is reached.
maximum		
	140.	When the maximum temperature is reached, the mercury stops moving. And, therefore, the steel index also _____(stops moving/ moves further).
	141.	If your answer is <u>stops moving</u>, go to frame No. 144. If your answer is <u>moves further</u>, go to frame No. 142.
	142.	When the temperature falls, the mercury _____ (expands/contracts)
contracts		
	143.	The contracting mercury moves _____(up/down).
down		
	144.	When the temperature falls, the steel index does not move with mercury because it is prevented by the hair _____.
spring		

145. Maximum temperature is recorded by the steady position of the _____
mercury level
steel index

---

146. If your answer is mercury level, go to frame No. 147.

If your answer is steel index, go to frame No. 157.

---

147. When the temperature rises, mercury expands and pushes the index _____ (upwards/downwards)

upwards — till the maximum temperature is reached.

---

148. When the temperature falls, mercury contracts and moves _____ (up/down).

down

---

149. But the steel index does not move because the hair spring prevents it from moving _____ (upwards/downwards).

downwards

---

150. The downward movement of the steel index is prevented by the _____.

hair spring

---

151. The mercury level falls with fall in temperature. So the maximum temperature cannot be indicated by the level of _____.

mercury

---

152. Tickmark _/_ the number of correct answer in the answer sheet.

When the mercury falls, the steel index
(i) moves upwards ( )
(ii) moves downwards ( )
(iii) does not move ( )

(iii) 6/

---

153. Maximum temperature of the day is recorded by the steady position of the _____ (mercury/index).

index

---

154. When the temperature falls, the level of _____ changes.

mercury

---

155. The index remains in the steady position showing the maximum temperature of the day because it is provided with the _____.

hair spring

---

156. The maximum temperature of the day is recorded by the lower end of the _____.

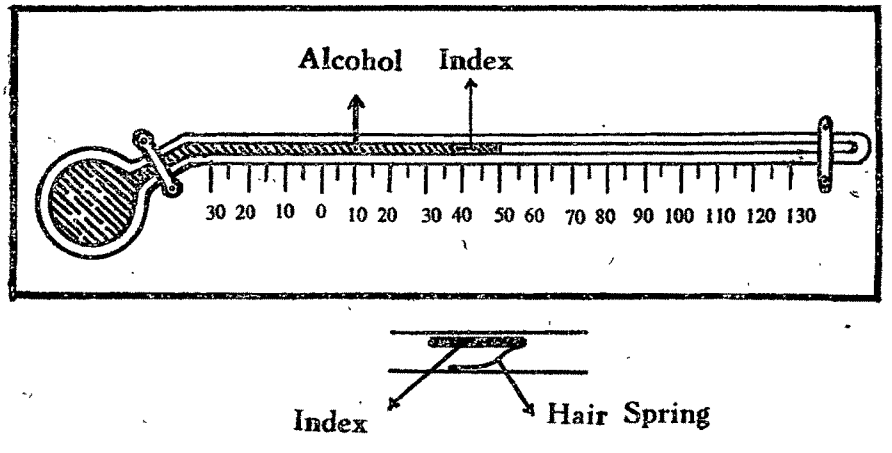
index

---

157. The minimum thermometer records the minimum temperature of the day.

Below is given a diagram of the minimum thermometer. Observe the figure carefully and answer the following :

THE MINIMUM THERMOMETER



The bulb and a part of the stem are filled with _____.

alcohol

---

158. The steel index is _____ (above/inside) the level of alcohol.

inside

---

falls	159.	As the temperature of the day falls, the level of alcohol _____ (rises/falls).
lower	160.	The scale extends below the 0°F on the _____ (lower/upper) side of the scale.
Yes	161.	So, can minimum thermometer record temperatures below the 0°F? _____ (Yes/No)
hair spring	162.	The index is provided with a .....
alcohol	163.	The steel index of the minimum thermometer is placed inside the _____ (alcohol/mercury).
No	164.	The steel index can move downwards only. Can the index move upwards? _____ (Yes/No)
expands	165.	When the temperature rises, alcohol _____ (expands/contracts) and moves upwards in the stem.
will not	166.	The index _____(will/will not) move upwards.
	167.	When alcohol expands and moves upwards, the steel index .....(moves upwards/does not move).
	168.	If your answer is moves upwards, go to frame No. 169. If your answer is does not move, go to frame No. 173.
upwards	169.	When the temperature rises, alcohol expands and moves _____ (upwards/downwards).

170. The index is provided with a special part called the .....

hair spring

---

171. The hair spring prevents the _____ from moving upwards.

index

---

172. So when the alcohol expands and moves upwards, the steady position of the index _____ (is/is not) changed.

is not

---

173. When the temperature falls, alcohol contracts and moves _____ (upwards/downwards).

downwards

---

174. When alcohol moves downwards, it drags the steel index _____ (upwards/downwards) alongwith it.

downwards

---

175. When the minimum temperature is reached, alcohol stops moving downwards.

Steel index ..... (stops moving/ moves downwards).

stops moving

---

176. The upward movement of the steel index of the minimum thermometer is prevented by the .....

hair spring

---

177. Tickmark the number of correct answer in the answer sheet.

When alcohol expands and moves upwards, the steel index

(i) moves upwards ( )

(ii) moves downwards ( )

(iii) does not move ( )

(iii) does not move _/

178. Tickmark _/ the number of correct answer

When alcohol contracts and moves downwards, the index

(i) moves upwards ( )

(ii) moves downwards ( )

(iii) does not move ( )

(ii) moves downwards (_/)

---

179. The minimum temperature of the day is recorded by the upper end of the _____.

index

---

180. Tickmark _/ the number of correct answer.

The part that records the minimum temperature of the day is

(i) the level of alcohol ( )

(ii) upper end of the index ( )

(iii) lower end of the index ( )

(ii) upper end of the index (_/)

---

181. Before using the maximum or minimum thermometers a second time the position of the steel _____ is to be adjusted using a small magnet (magnet attracts steel).

index

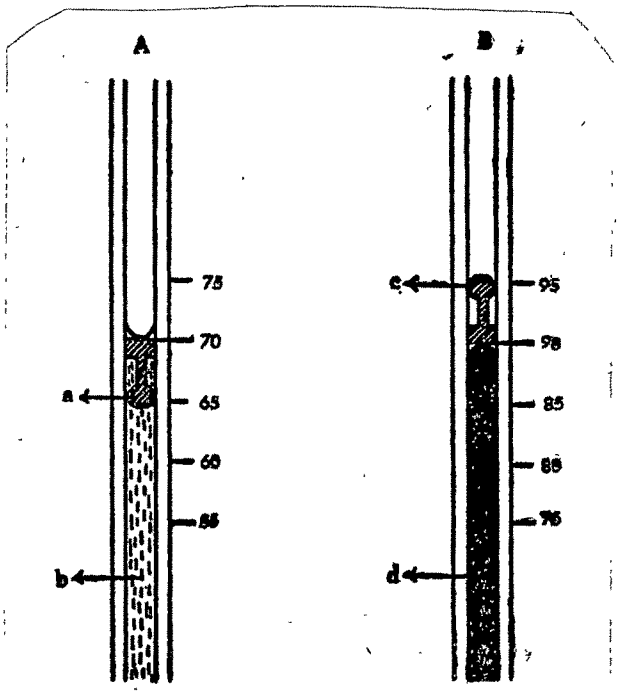
---

182. Using a magnet, the index of the minimum thermometer is to be brought _____ (above/inside) the alcohol.

inside

---

183. In the figure, the position of the indices of maximum thermometer and minimum thermometer are given. Observe the figure carefully and answer the following:



(a) minimum
(b) maximum

(a) The figure A shows the _____(maximum/minimum) thermometer.
(b) The figure B shows the _____(maximum/minimum) thermometer.

---

above

184. In the maximum thermometer the index is _____ (above/inside) the mercury.

---

alcohol

185. In the minimum thermometer the index is inside the _____ (write the name of the liquid).

70

186. The upper end of the index in the minimum thermometer is at _____°F.

90

187. The lower end of the index in the maximum thermometer is at _____°F.

---

maximum

188. 90°F indicates the _____ (maximum/minimum) temperature of the day.

70

189. Minimum temperature of the day is _____°F.

---

190. Maximum temperature is recorded by the _____ (upper/lower) end of the index.

---

191. Tickmark (_/) in the answersheet the TWO parts of the maximum and minimum thermometers not found in common thermometers :

	(a) Scale	( )
	(b) Glass tube	( )
	(c) Hair Spring	( )
	(d) Bulb	( )
(c) Hair spring (_/)	(e) Index	( )
(e) Index (_/)	(f) Mercury	( )

192. Below is given a table comparing the maximum and minimum thermometers. Column I gives the points of comparison and alternative answers. Fill in the blanks in Columns II and III by selecting the correct words given in brackets in Column I in the answer sheet.

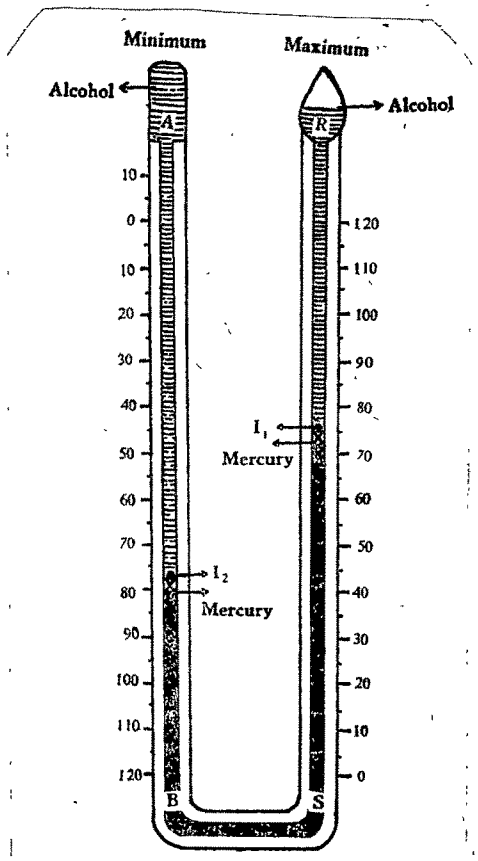
I Points of Comparison	II Maximum thermometer	III Minimum thermometer
1. Liquid used is (alcohol/mercury).	_____	_____
2. Index is (above/ inside) the liquid.	_____	_____
3. Index moves(upwards/ downwards).	_____	_____
4. Temperature of the day is recorded by this end of the index (lower end/ upper end).	_____	_____
5. Index moves when the liquid (falls/ rises).	_____	_____

1. Mercury, alcohol
2. above, inside
3. upwards, downwards
4. lower end, upper end
5. rises, falls

193. So far we have studied the maximum and minimum thermometer separately. We have combined thermometer called Six's Thermometer, which records both the maximum and minimum temperature of a _____ (day/substance).

day

194. Observe the figure of Six's thermometer carefully and answer the following questions :



SIX'S THERMOMETER

(a) U

(a) Six's thermometer consists of a ____ shaped glass tube.

(b) alcohol
mercury

(b) Six's thermometer contains the liquids _____ and _____.

(c) maximum
minimum

(c) It is two arms, one for recording the _____ temperature and the other for recording the _____ temperature of the day.

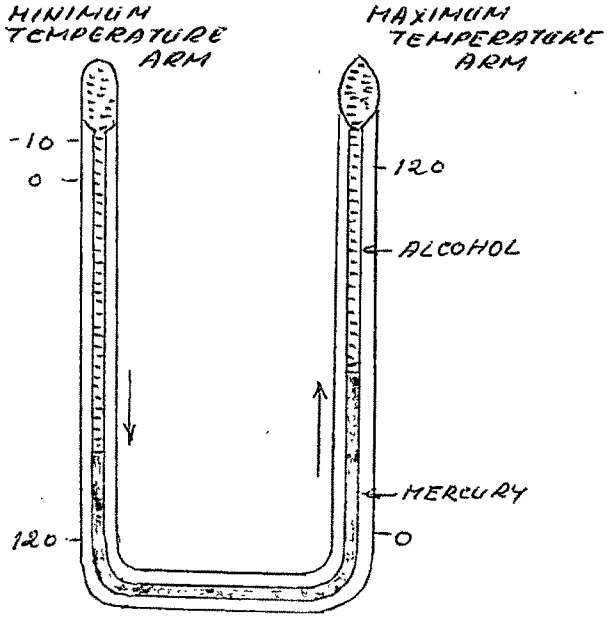
(d) maximum

(d) There is a vacuum in the arm carrying the _____(maximum/minimum) temperature scale.

(e) bottom
top

(e) The maximum temperature scale starts from the _____(bottom/top) while the minimum temperature scale starts from the _____.

195. Observe the figure carefully and answer the following frames :



When the temperature rises, the mercury and alcohol _____ (expand/contract) and mercury moves upwards in the maximum temperature arm.

expand

196. When the temperature rises, the mercury level in the minimum temperature arm _____(falls/rises).

197. If your answer is falls, go to frame No. 203.
If your answer is rises, go to frame No. 198.

198. Both the maximum and minimum temperature arms of the Six's thermometer are _____ (disconnected/connected).

connected

199. The mercury in Six's thermometer _____ (can/cannot) flow from one arm to the other.

200. When the temperature rises, alcohol and mercury expand and move upwards in the maximum temperature arm. So mercury level _____ (rises/falls) in the maximum temperature arm.

rises

---

201. When the temperature rises, mercury level rises in the _____ (maximum/minimum) temperature arm.

maximum

---

202. When the mercury level rises in one arm, it falls in the other arm. With rise in temperature, mercury level rises in the maximum temperature arm. Mercury level in the minimum temperature arm _____ (rises/falls).

falls

---

203. The index in the maximum temperature arm is above the level of _____.

mercury

---

204. The mercury while expanding pushes the index _____ (upwards/downwards) till the maximum temperature is reached.

upwards

---

205. When the maximum temperature is reached, the mercury does not rise further.

So at the maximum temperature the index _____ _____ (remains steady/moves further).

remains steady

---

206. Steel index does not move from its steady position because it is prevented by the .....

hair spring

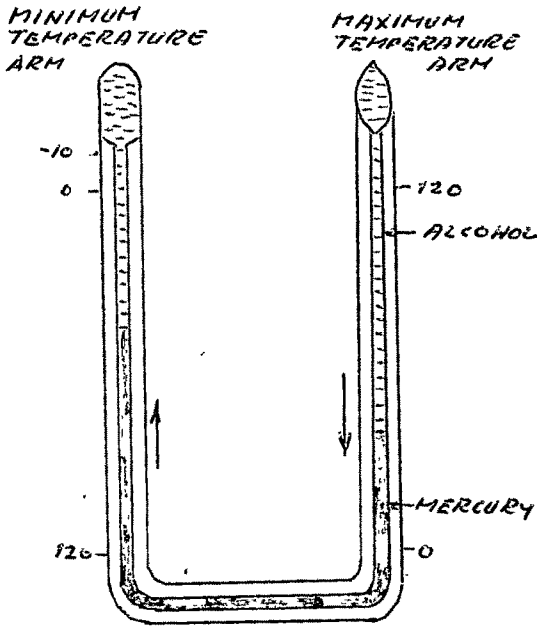
---

207. The scale of the maximum temperature arm starts from the bottom. So higher the position of the index, _____ (higher/lower) will be the temperature of the day.

higher

---

208. Observe the figure carefully and answer the following frames :



When the temperature falls, the level of mercury _____ (rises/falls) in the maximum temperature arm.

falls

---

209. When the temperature falls, the index in the minimum temperature arm moves _____(upwards/downwards).

---

210. If your answer is upwards, go to frame No. 216.

If your answer is downwards, go to frame No. 211.

---

211. When the temperature _____ (rises/falls), the mercury and alcohol contract.

falls

---

212. When the temperature falls, the level of mercury _____ (rises/falls) in the maximum temperature arm.	falls
213. Level of mercury rises in the _____ temperature arm.	minimum
214. The mercury in the minimum temperature arm moves upwards and pushes the _____ upwards.	index
215. When the temperature falls, the index in the minimum temperature arm moves _____ (upwards/downwards).	upwards
216. When the minimum temperature is reached, the index ..... (remains steady/ moves further).	remains steady
217. Minimum temperature can be noted even after sometime because the _____ remains steady.	index
218. The scale in the minimum temperature arm starts from the top. So higher the position of the index, _____ (lower/higher) will be the temperature.	
219. In the Six's thermometer both the indices are above the level of _____.	mercury
220. In Six's thermometer both the indices are pushed _____ (upwards/downwards) by mercury.	upwards
221. The index in the maximum temperature arm is pushed upwards when the mercury _____ (expands/contracts).	expands

222. The index in the minimum temperature arm is pushed _____ (upwards/downwards) when the mercury contracts.

upwards

---

223. The temperature scale in the minimum temperature arm starts from the _____ (top/bottom).

top

---

224. Answer the following in the answer sheet.

(a) Six's thermometer is a _____ shaped thermometer.

(b) How many indices are there in the Six's thermometer? _____

(c) What are the liquids used in the Six's thermometer? _____, _____

(d) In Six's thermometer, both the indices are pushed by _____ (alcohol/mercury).

(e) In Six's thermometer, both the indices move _____ (upwards/downwards).

(f) In Six's thermometer, the maximum temperature scale starts from the _____ (bottom/top) while the minimum temperature scale starts from the _____.

(a) U

(b) 2 or two

(c) mercury
alcohol

(d) mercury

(e) upwards

(f) bottom,
top

225-A. Clinical thermometer is used to record the temperature of human body while Six's thermometer records the maximum and minimum temperature of the day.

In the figure given below the parts of the clinical thermometer are marked by different letters.

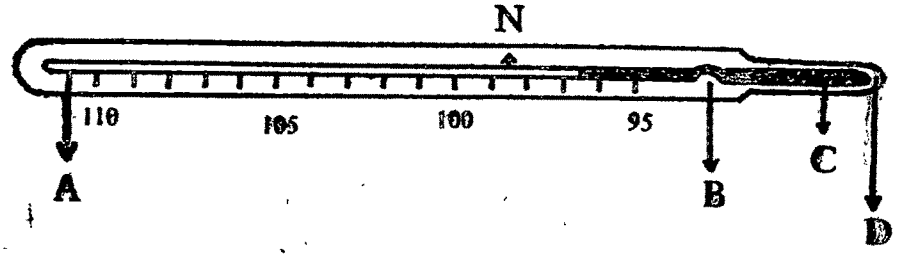
Part A : Shows the stem of the thermometer.

Part B : Shows the bent called constriction.

Part C : Shows mercury used in the thermometer.

Part D : Shows the bulb which is filled with mercury.

Part N : The arrow at N (98.4°F) shows the normal body temperature.



Observe the figure and try to recognize the names of the parts. Now go to B part of this page.

225-B. Given below are the parts of clinical thermometer.

Observe the figure given above carefully and indicate which part is marked by which letter in the figure.

1. D — 1. Bulb is marked by the letter _____.

2. C — 2. Mercury is marked by the letter _____.

3. B — 3. Constriction is marked by the letter _____.

4. N — 4. Normal body temperature is marked by the letter _____.

5. 98.4 — 5. The value marked at N is _____°F.

6. A — 6. The stem is marked by the letter _____.

---

226. In order to measure the body temperature of the patient, the bulb of the _____ thermometer is put under the tongue or in the arm pit of the patient.

clinical

---

227. The mercury expands and moves upwards due to the _____ (rise/fall) in the body temperature of the patient.

rise

---

228. The special bent part above the bulb of the clinical thermometer is called the _____.

constriction

---

229. The constriction allows the mercury to pass through it in the upward direction only.

The constriction does not allow the mercury to move in the _____ (upward/downward) direction.

downward

---

230. The downward movement of the mercury is prevented by the _____ (bulb/constriction) of the thermometer.

---

231. If your answer is bulb, go to frame No. 232.

If your answer is constriction, go to frame No. 237.

---

232. In most of the thermometers there is a special part at the lower end of the thermometer called the _____.

bulb

---

233. The bulb of the clinical thermometer contains _____. (Write the name of the liquid).

mercury

---

234. There is a special bent in the clinical thermometer called the constriction. The constriction is _____ (above/below) the bulb.

above

---

235. Constriction does not allow the _____ to move downwards.

mercury

---

236. So when the clinical thermometer is removed from the body, the mercury does not move downwards because it is prevented by the _____.

constriction

---

237. The body temperature of a patient is indicated by the steady position of the _____.

mercury

---

238. When the patient has fever, the steady level of mercury _____ (above/below) the constriction indicates his body temperature.

above

---

239. After recording the temperature of a patient, the clinical thermometer should be shaken in order to bring the mercury _____ (downwards/upwards).

downwards

---

240. If the clinical thermometer is washed with water above 110°F, the _____ in the thermometer expands to the high temperature and forces through the glass and breaks the thermometer.

mercury

---

241. Clinical thermometer should be washed with _____ (cold water/boiling water).

---

242. If your answer is cold water, go to frame No. 248.

If your answer is boiling water, go to frame No. 243.

---

243. The temperature of boiling water is _____ (212°C/212°F).

212°F

---

244. The stem of the clinical thermometer is graduated upto _____ (110°C/110°F).

110°F

---

245. The maximum temperature to which the mercury in the clinical thermometer can expand in it is _____ (higher/lower) than the boiling point of water.

lower

---

246. So when the clinical thermometer is washed with the boiling water which is at 212°F, the mercury _____ (expands/contracts) too much. This breaks the clinical thermometer.

expands

---

247. Clinical thermometer should be washed with ..... (boiling water/cold water).

cold water

---

248. Complete the following sentences by selecting the correct words from the list given below :

WORDS: magnet, index, bulb, hair spring, arrow, constriction, vacuum.

(a) The thermometer would burst at higher temperature if there is no _____ above the mercury in the thermometer.

(b) The steel index is prevented from moving by the _____ _____.

(c) The back flow of mercury in clinical thermometer is prevented by the _____.

(d) The index is reset using a small _____.

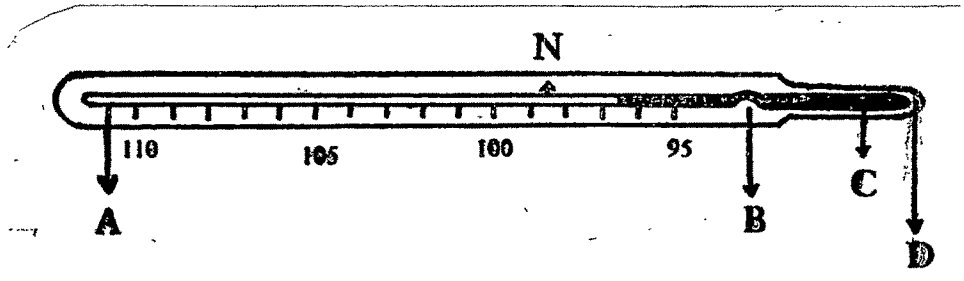
(e) In Six's thermometer the temperature of the day is indicated by the _____.

(f) To measure the temperature of water, the _____ of the thermometer is immersed in it.

(g) Normal body temperature (98.4°F) is shown in the clinical thermometer by the _____.

(a) vacuum
(b) hair spring
(c) constriction
(d) magnet
(e) index
(f) bulb
(g) arrow

249. Below is given the diagram of clinical thermometer. Some parts of it are marked by A, B, C, D and N. Write the names of the parts in the blanks provided below.



(1) stem
(2) constriction
(3) mercury
(4) bulb
(5) normal body temperature
(6) 98.4

(1) Part A is the .....
(2) Part B is the .....
(3) Part C is the .....
(4) Part D is the .....
(5) Arrow indicates the .....
(6) N is at the temperature of _____°F.

Some interesting things about thermometers :

* Galileo at the end of 16th century prepared a water thermometer (the first thermometer).
* Amonton discovered that water always boiled at the same temperature at sea level.
* Fahrenheit discovered mercury to be the most suitable thermometric liquid. He constructed a mercury thermometer called Fahrenheit thermometer.
* Celsius constructed the Centigrade thermometer.

Answer the following :

(a) The use of mercury was discovered by .....

(b) The first thermometer was constructed by .....

(c) Centigrade thermometer was constructed by .....

(d) Steady boiling point of water was discovered by .....

Answers

(a) Fahrenheit
(b) Galileo
(c) Celsius
(d) Amonton

Answers are given on the left side of this page.

NOW THE PROGRAMME IS OVER

A PROGRAMMED TEXT ON THERMOMETER

RESPONSE PROMPT FORM
(WRITING FORM)

About This Programme.....

On reading this programme, you will know many interesting things about thermometers. Thermometers are the instruments used to measure the heat levels. You have to know something about thermometers because we will be using them in hospitals, laboratories, houses and so on.

How to Read This Book

(1) This book contains small steps called frames.

(2) Most of the frames contain one or two words underlined. You have to give a special attention to these words.

(3) Read the frames carefully and understand the importance of the words underlined.

(4) Write down the underlined or tick marked word or words against serial number of the question in the answersheet given to you. Do not write anything in this book.

(5) Write down only when you are sure that you have understood the frame and the word(s) underlined.

(6) Go to the next frame after understanding the frame and writing down underlined or tickmarked word or words in the answer sheet.

READ the frame
OBSERVE the words underlined
UNDERSTAND the frame
WRITE the words underlined
PROCEED FURTHER

.....

1. A beaker filled with water is kept on fire.

   (a) Does the water get heated? Yes

   (b) Its heat level rises.

---

2. A pot of water is kept in ice.

   (a) It gets cooled.

   (b) Its heat level falls.

---

3. On heating, the heat level of water rises.
   On cooling, the heat level of water falls.

   Can the heat level be changed by heating or cooling?
   Yes

---

4. Ice water and boiling water differ in their heat levels.

   In other words, ice water and boiling water differ in their temperatures.

   Does the temperature indicate the heat level of a substance? Yes

---

5. (a) Temperature indicate the heat level of a substance.

   (b) When the heat level is high, we say that the temperature is high.

   (c) When the heat level is low, we say that the temperature is low.

---

6. The heat level of a substance is scientifically known as the temperature of that substance. A substance at low temperature is said to be cold.
   (a) A substance at high temperature is said to be hot.

---

7. (a) If the temperature of a substance is high we say that it is hot.

   (b) If the temperature of a substance is low we say that it is cold.

---

8. What are the common words used to indicate the following?

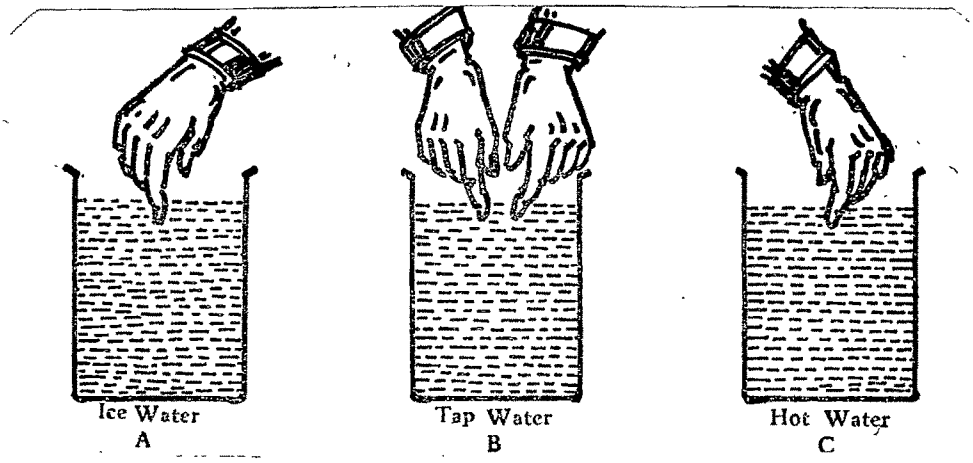
(a) Low temperature : cold

(b) High temperature : hot

---

9. The following is one way of FEELING whether a substance is cold or hot.

Observe the figure carefully.



(a) Ram dipped his right hand finger in the beaker A.
It was felt cold.

(b) Ram dipped his left hand finger in the beaker C.
It was felt hot.

---

10. Then he dipped both the fingers in the beaker B. To the right hand, the water in the beaker B was felt hot and to the left hand it was felt cold.

Can the exact temperature of water be known by touching it? No

---

11. Tickmark _/ shows the correct answer.

Ram's experience regarding the temperature of water in the beaker B.

(i) remained the same ( )

(ii) differed from hand to hand. (_/)

---

12. By touching the tap water, Ram could not know its exact temperature.

---

13. Heat level or temperature of a substance can be measured scientifically using a thermometer.

The instrument used to measure the temperature of a substance is called thermometer.

---

14. To measure the temperature of a substance we use an instrument called thermometer.

---

15. Can Ram know the exact temperature of water in the beaker B by using a thermometer? Yes

---

16. (a) When a substance is heated, its temperature rises.

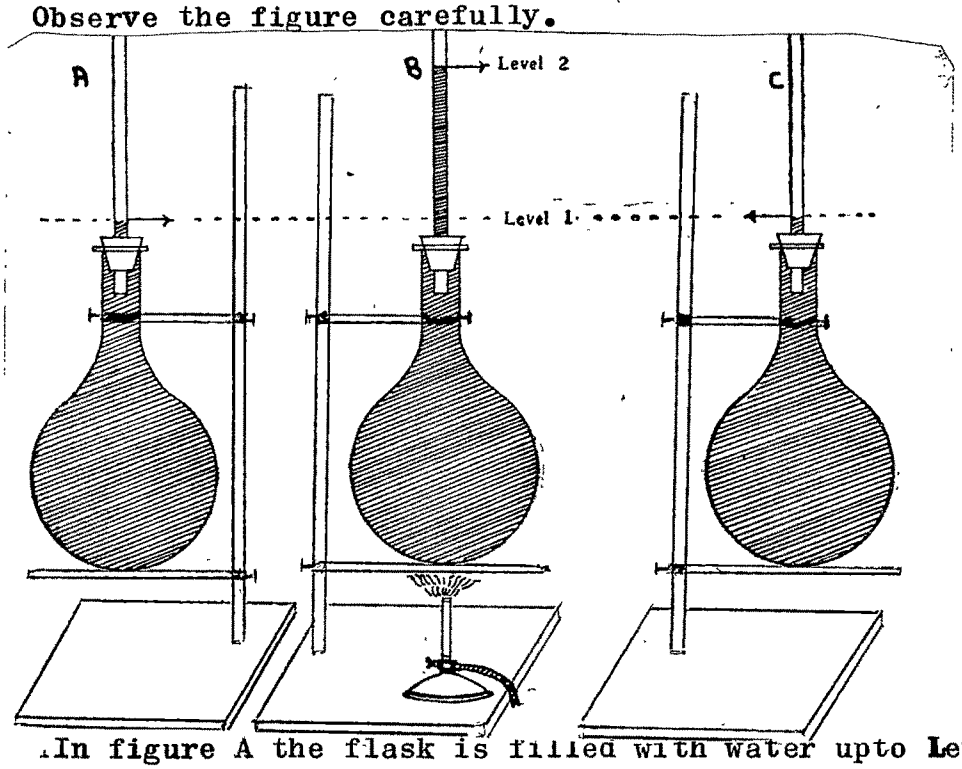
(b) When a substance is cooled, its temperature falls.

---

17. On heating or cooling a substance, its temperature changes.

---

18. Observe the figure carefully.



In figure A the flask is filled with water upto Level 1.

(a) The flask is heated with a burner as shown in the figure B.

Due to heating, the level of water rises from Level 1 to Level 2.

---

19. Burner is removed and the flask is cooled.
On cooling, the level falls as shown in figure C.

---

20. Tickmark _/ shows the correct answer.
Rise in the level of water in figure B is due to

(a) cooling ( )
(b) adding some more water ( )
(c) heating (_/)

---

21. The level of milk rises when it is heated. But on cooling, its level falls.

---

22. When any liquid (milk or water) is heated, its level rises and it occupies more space.

---

23. Occupying more space on heating is called expansion.

---

24. When water is cooled, its level falls and it occupies less space.

---

25. Occupying less space on cooling is called contraction.

---

26. When the temperature of a substance falls, it contracts.

---

27. Tickmark _/ shows the correct answer.

Expansion means :

(i) occupying more space on cooling ( )

(ii) occupying less space on cooling ( )

(iii) occupying more space on heating (_/)

(iv) occupying less space on heating ( )

---

28. Below are given some words related to expansion and contraction. Tickmark _/ indicate only those related to contraction :

(i) Cooling (_/)

(ii) Fall in the temperature (_/)

(iii) Occupying less space (_/)

(iv) Rise in the temperature ( )

(v) Occupying more space ( )

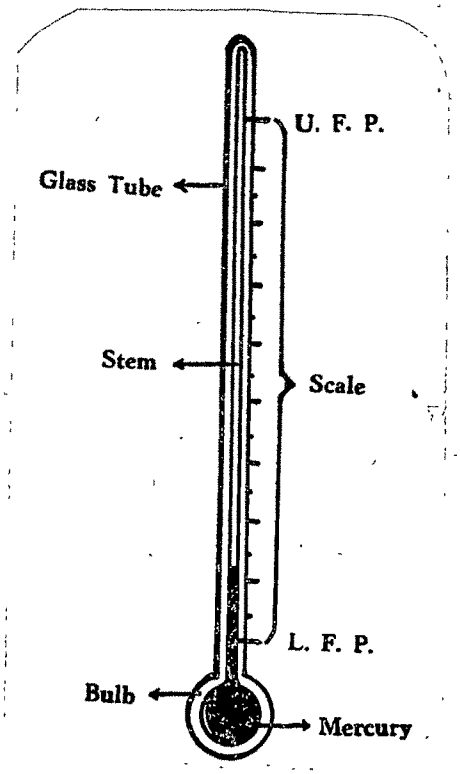
(vi) Heating ( )

---

29. Thermometer is constructed on the principle that liquids expand with rise in the temperature and contract with fall in temperature.

---

30. Below is given the figure of a thermometer. Study the figure carefully and recognize the various parts of it.



(a) The lower end of the thermometer which is filled with mercury is called the bulb.

(b) Thermometer has a scale to measure the temperature of a substance.

(c) The scale is marked on the stem.

In the figure above, some divisions are marked on the stem of the thermometer. These divisions make a scale which helps to measure temperature.

---

31. (a) The thermometer is filled with mercury.

Tickmark _/ shows the correct answer :

(b) Mercury is filled in the :

(i) entire stem ( )

(ii) part of the stem (_/)

(c) U.F.P. is at the upper end of the temperature scale.

---

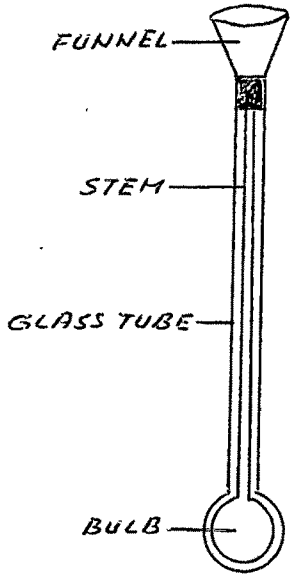
32. U.F.P. denotes the upper fixed point of the scale. The lower fixed point of the scale is marked as L.F.P.

---

33. Thermometer is constructed on the principle of expansion and contraction of liquids.

Let us see the material used in the construction of the common thermometer.

Study the figure carefully.



A tube with narrow and uniform bore which is made up of glass is taken.

---

34. (a) The lower end of the glass tube is blown into a bulb.
(b) The funnel is at the upper end of the tube.

---

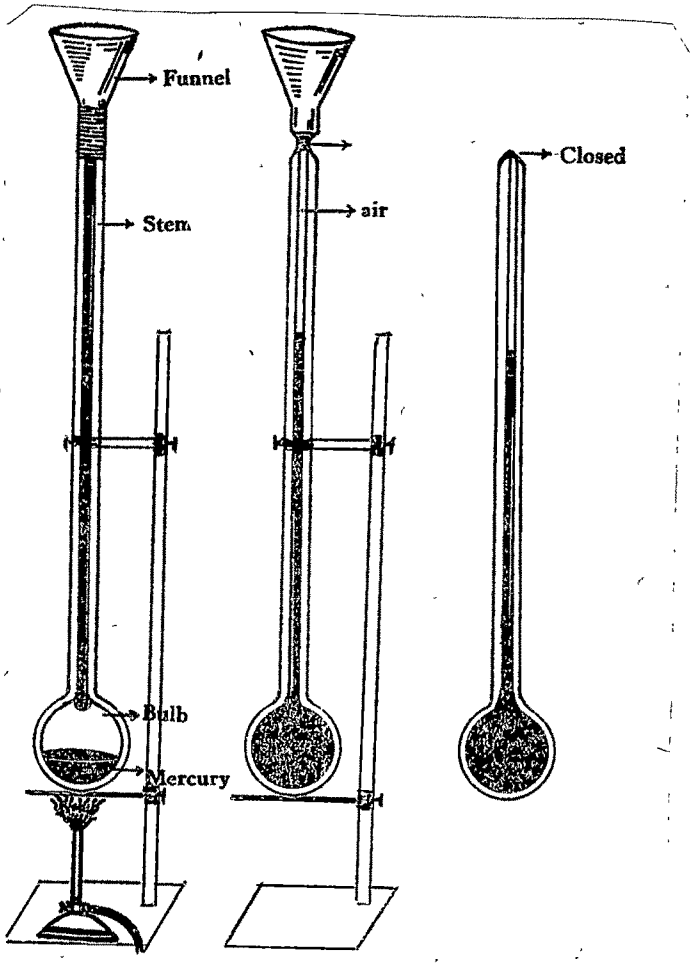
35. The upper end is used to pour the mercury into the glass tube.

---

36. The upper end is in the shape of a funnel through which mercury can be poured.

---

37. The following frames describe the process of filling the bulb and the stem with mercury and sealing its upper end. Study the figure carefully.



(a) The mercury is poured through the funnel.

(b) After pouring some mercury, the bulb is heated with the burner.

38.	The glass tube contains air inside it. On heating, the mercury expands and drives the air out.
39.	Burner is removed and the glass tube is allowed to cool down. The mercury in the glass tube becomes cold.
40.	Heating and cooling are repeated till the entire bulb and a part of the stem are filled with mercury.
41.	The mercury is heated in order to drive all the air out.

42. After driving all the air out, the upper end is <u>closed</u>.

---

43. Tickmark _/ shows the correct answer.

The bulb is strongly heated in order to :

(i) seal the thermometer ( )
(ii) drive the air out (_/)
(iii) make the mercury expand ( )

---

44. The air above the mercury level is driven out. Thus a vacuum is created. This vacuum is <u>above</u> the mercury level.

---

45. After sealing the upper end, there is <u>vacuum</u> above the mercury level.

---

46. After sealing the upper end there is no air (= vacuum) above the level of <u>mercury</u>.

---

47. There is <u>vacuum</u> above the mercury level.

---

48. The mercury expands when there is a <u>rise</u> in temperature.

---

49. The thermometer would burst if there is no space for the <u>mercury</u> to expand.

---

50. The thermometer would burst at higher temperature if there is no <u>vacuum</u>.

---

51. Vacuum allows the mercury to <u>expand</u>.

---

52. The level of shining liquid can be seen clearly through the glass. So shining liquids are highly suitable to be used in the thermometer.

Mercury is used in the thermometers because it is a <u>shining</u> liquid.

---

53. Liquids which wet the glass do not show exact readings. Mercury shows the exact readings because it <u>does not wet</u> the glass.

---

54. The liquid used in the thermometers should be a good conductor of heat (i.e. it should take up heat readily).

Mercury is used in the thermometers because it is a good <u>conductor</u> of heat.

---

55. Bad conductors do not take up heat readily.

Can we find out small changes in temperature using a bad conductor of heat (i.e. one which does not take up heat readily)? <u>No</u>

---

56. Of the following, tickmarks _/ show the reasons why mercury is used in the thermometers :

(a) Mercury cannot be seen through the glass. ( )

(b) Mercury is sensitive to even small changes in temperature. (_/)

(c) Mercury does not wet the glass. (_/)

(d) Mercury expands and contracts very slowly. ( )

(e) Mercury can be seen through the glass. (_/)

(f) Mercury is a shining solid. ( )

(g) Mercury is a shining liquid. (_/)

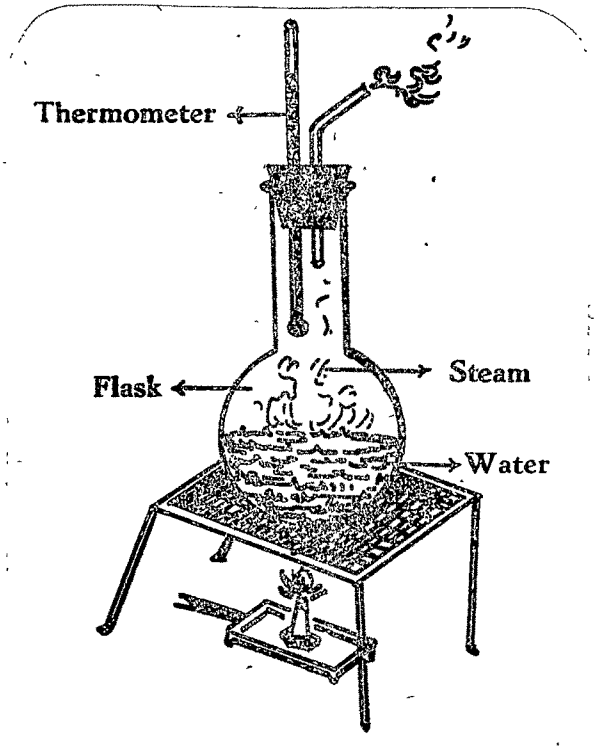
(h) Mercury sticks to the glass. ( )

---

57. On the stem of the thermometer are marked the two important points of the temperature scale, namely, the U.F.P. and the L.F.P.

In the following frames the procedure of marking the U.F.P. is described.

Observe the figure carefully.



MARKING THE U. F. P.

(a) The thermometer is kept above the level of boiling water.

(b) Due to the high temperature of boiling water, the mercury level in the thermometer rises.

---

58. (a) After reaching a point (at the boiling point of water), the level of mercury in the thermometer does not rise further.

(b) This point is marked as the upper fixed point.

---

59. The temperature at which water boils and turns into steam is called the boiling point of water.

---

60. The mercury remains steady at the boiling point of water.

---

61. Upper fixed point (U.F.P.) of the temperature scale is marked at that point where the mercury level is steady.

---

62. The boiling point of water at which the mercury level is steady is marked as the Upper Fixed Point or U.F.P. of the scale.

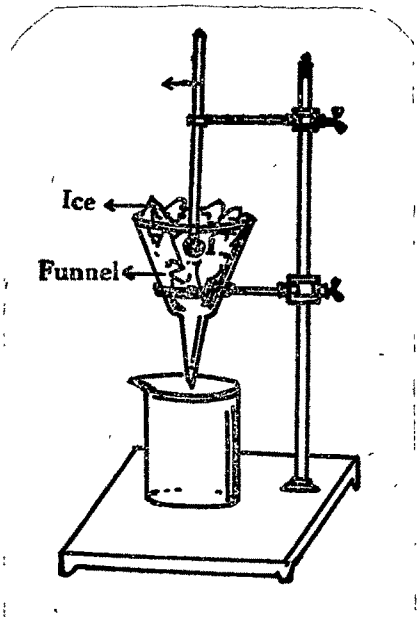
---

63. Does the U.F.P. indicates the boiling point of water? Yes

---

64. We have seen that the U.F.P. is marked at the boiling point of water. In the following frames the process of marking the Lower Fixed Point (L.F.P.) of the temperatures scale is described.

Observe the figure carefully.



MARKING THE L. F. P.

Bulb of the thermometer is put in a funnel filled with melting ice.

---

65. Due to the low temperature of melting ice, the level of the mercury falls.

---

66. (a) After reaching a point (at the melting point of ice) the level of mercury does not fall further.

(b) This point is marked as the Lower Fixed Point.

---

67. The temperature at which ice melts is called the melting point of ice.

---

68. Mercury remains steady at the melting point of ice.

---

69. Lower Fixed Point (L.F.P.) is marked at the point where mercury level is steady.

---

70. The mercury level remains steady at the melting point of ice. This is marked as the Lower Fixed Point or L.F.P. of the scale.

---

71. Tickmark _/ shows the correct answer.

U.F.P. indicates the :

(i) melting point of ice. ( )

(ii) boiling point of water. (_/)

---

72. Tickmark _/ shows the correct answer.

The fixed point marked at the melting point of ice is the :

(i) L.F.P. (_/)

(ii) U.F.P. ( )

---

73. There are many divisions between the L.F.P. and U.F.P. These divisions are marked with numbers. The process of marking the divisions and numbers between the U.F.P. and L.F.P. is called graduating the thermometer.

---

74. Marking the divisions and numbers of the temperature scale is called graduating the thermometer.

---

75. Graduating the thermometer is the process of marking the divisions and numbers of the temperature scale.

---

76. The divisions and numbers are made after marking the upper and lower fixed points.

---

77. By marking the divisions and numbers, we get the temperature scale.

---

78. After graduating (marking the divisions and numbers) we get either the Centigrade (C) scale or Fahrenheit (F) scale of temperature. C and F scales differ in 3 ways :

(i) the value of L.F.P.

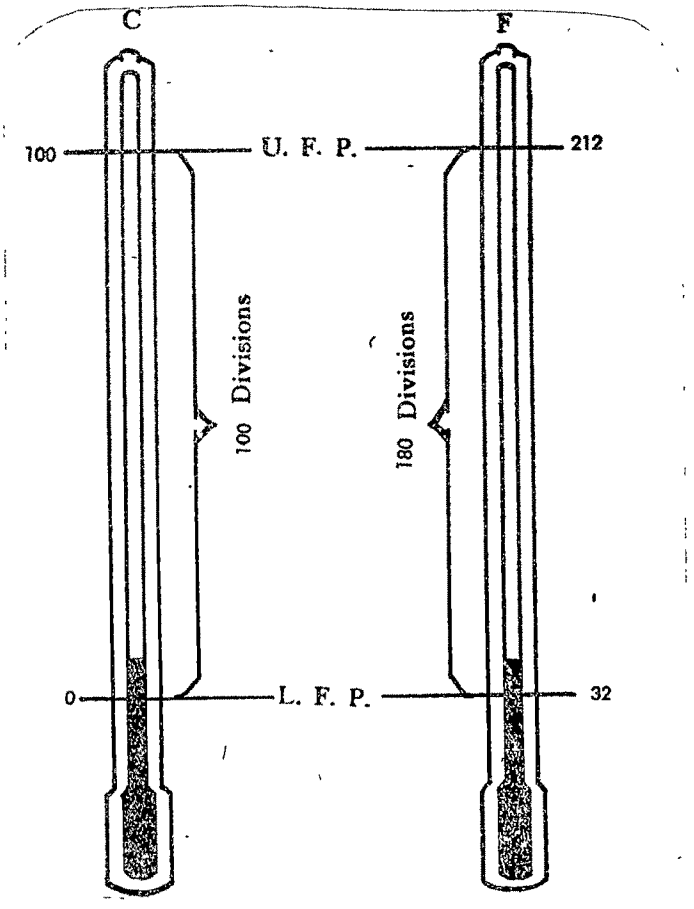
(ii) the value of U.F.P.

(iii) the number of divisions between U.F.P. and L.F.P.

Do C and F scales contain the same number of divisions between U.F.P. and L.F.P.? No

---

79. Now we shall study the differences between the C and F scales. Observe the figure carefully.



U.F.P.

(a) U.F.P. marked on the C scale is 100°C.

(b) U.F.P. marked on the F scale is 212°F.

---

80. L.F.P.

(a) L.F.P. marked on the C scale is 0°C.

(b) L.F.P. marked on the F scale is 32°F.

---

81. Number of divisions between the U.F.P. and L.F.P.

(a) How many divisions are there in a C scale? 100.

(b) How many divisions are there in a F scale? 180.

(c) 32°F is the L.F.P. of F scale.

---

82. 32°F is marked at the L.F.P. of the F scale.

---

83. Using a Centigrade scale, can we measure temperature very much higher than 100°C? No

---

84. What are the following abbreviations and symbols stand for?

(i) L.F.P. : Lower Fixed Point

(ii) ° : Degree

(iii) °C : Degree Centigrade

(iv) U.F.P. : Upper Fixed Point

(v) F : Fahrenheit

(vi) C : Centigrade

---

85. Compare the Centigrade and Fahrenheit scales.

	Centigrade	Fahrenheit
(a) U.F.P. is	100°C	212°F
(b) L.F.P. is	0°C	32°F
(c) No. of divisions are	100	180

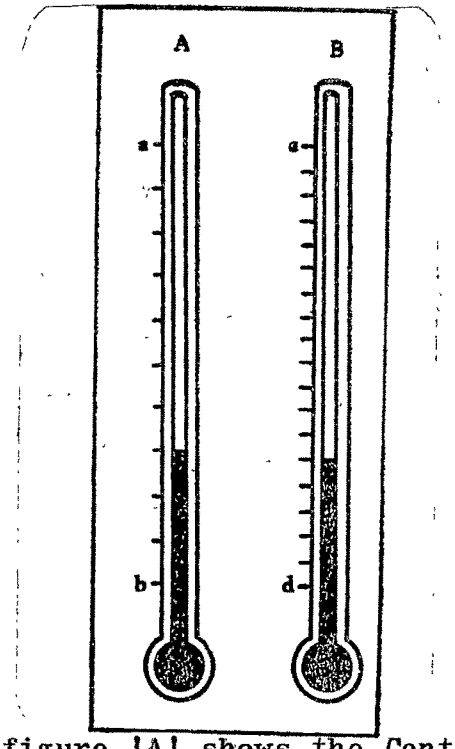
---

86. Observe the figure carefully.

The parts of the two thermometers with their U.F.P. and L.F.P. are shown.

Figure A shows the scale that contains 100 divisions.

Figure B shows the scale that contains 180 divisions.



A. (1) The figure 'A' shows the Centigrade thermometer.

(2) The figure 'B' shows the Fahrenheit thermometer.

B. (1) Value at 'a' is 100°C.

(2) Value at 'b' is 0°C.

(3) Value at 'c' is 212°F.

(4) Value at 'd' is 32°F.

---

87. Temperatures are written as 23°C, 71°F, 4.8°C, 5.6°F etc.

Two decimal eight degrees Fahrenheit is written as 2.8°F.

---

88. Twentytwo degrees Centigrade is written as 22°C.

---

89. 61°C is the temperature which is 61 degrees above the zero degree of Centigrade.

---

90. If the temperature is expressed in Fahrenheit scale, the symbol F is to be used.

---

91. Temperature below the 0° are expressed with a minus sign.
-61°C is a temperature which is below the 0°C.

---

92. -47°F is temperature which is 47 degrees below the 0°F.

---

93. 17 degrees below the 0°C is written as -17°C.

---

94. -38°F is a temperature, 38 degrees below the 0°F.

---

95. Tickmark ✓ shows the correct answer.
-23°F is a temperature which is :
(i) above the 0°F ( )
(ii) below the 0°F (✓)
(iii) below the 0°C ( )

---

96. (a) To find the temperature of hot water, the bulb of the thermometer is immersed in hot water.
(b) Due to the high temperature of hot water, there is a rise in the mercury level.
(c) The main scale divisions to which the level of mercury rises is noted.
(d) The number marked on that particular division where mercury level remains steady gives the temperature of the hot water.

---

97. The temperature of water at 50°C is more than the temperature of water at 40°C.

---

98. The bulb of a thermometer is first kept in water at 50°C. Then it is kept in water at 45°C. The level of mercury at 50°C is comparatively higher than that at 45°C.

---

99. When the mercury level is higher, we can say that the temperature is comparatively high.

---

100. Below are given the steps followed in using a thermometer. But it is not given in the proper order. The correct order of the steps is written in the brackets.

1. ..... Final recording of temperature e.g. 51°C (4)

2. ..... Mercury level of thermometer changes. (2)

3. ..... Bulb of the thermometer is put in the liquid. (1)

4. ..... Main scale division near the mercury level is noted. (3)

---

101. Common thermometers are used to measure the temperature of a substance. To measure the atmospheric temperature of a day, that is, the maximum and minimum temperatures of a day, or the body temperature of a patient, we need some special thermometers.

The minimum temperature of a day can be measured using a special thermometer.

---

102. Thermometers which record the atmospheric temperatures of a day :

(i) Maximum thermometer

(ii) Minimum thermometer

(iii) Six's thermometer

Thermometer to measure our body temperature :

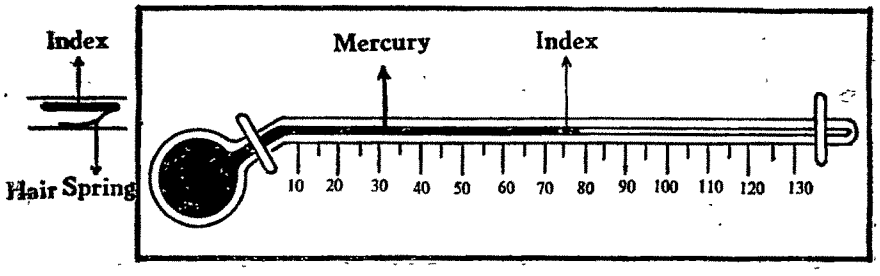
(i) Clinical or Doctor's thermometer.

Maximum thermometer records the maximum temperature of the day.

---

103. Maximum thermometer records the maximum temperature of the day. Observe the figure of the maximum thermometer carefully and recognize the parts before you proceed further.

THE MAXIMUM THERMOMETER



(a) The bulb and a part of the stem of the maximum thermometer are filled with mercury.

(b) The steel index is above the level of mercury.

(c) Look at the enlarged figure of steel index. It consists of a special part called hair spring.

(d) Hair spring is a part of steel index.

(e) The scale is marked from 10°F to 130°F.

---

104. The steel index is shown separately in its enlarged form. It consists of two important parts namely index and hair spring.

---

105. (a) The scale is marked from 10°F to 130°F.
(b) The highest value of the scale (130°F) shown in the figure is away from the bulb.

---

106. Above the level of mercury is a steel index.

---

107. When the temperature of the day rises, the mercury expands and moves upwards.

---

108. The index is above the level of mercury.

---

109. So the rising mercury pushes the index upwards.

---

110. The upward movement continues till the maximum temperature is reached.

---

111. When the maximum temperature is reached, the mercury stops moving. And, therefore, the steel index also stops moving.

---

112. When the temperature falls, the mercury contracts.

---

113. The contracting mercury moves down.

---

114. When the temperature falls, the steel index does not move with mercury because it is prevented by the hair spring.

---

115. When the temperature rises, mercury expands and pushes the index upwards till the maximum temperature is reached.

---

116. When the temperature falls, mercury contracts and moves down.

---

117. But the steel index does not move because the hair spring prevents it from moving downwards.

---

118. The downward movement of the steel index is prevented by the hair spring.

---

119. The mercury level falls with fall in temperature. So the maximum temperature cannot be indicated by the level of mercury.

---

120. Tickmark _/ shows the correct answer.
When the mercury falls, the steel index
(i) moves upwards ( )
(ii) moves downwards ( )
(iii) does not move (_/)

---

121. Maximum temperature of the day is recorded by the steady position of the index.

---

122. When the temperature falls, the level of mercury changes.

---

123. The index remains in the steady position showing the maximum temperature of the day because it is prevented by the hair spring.

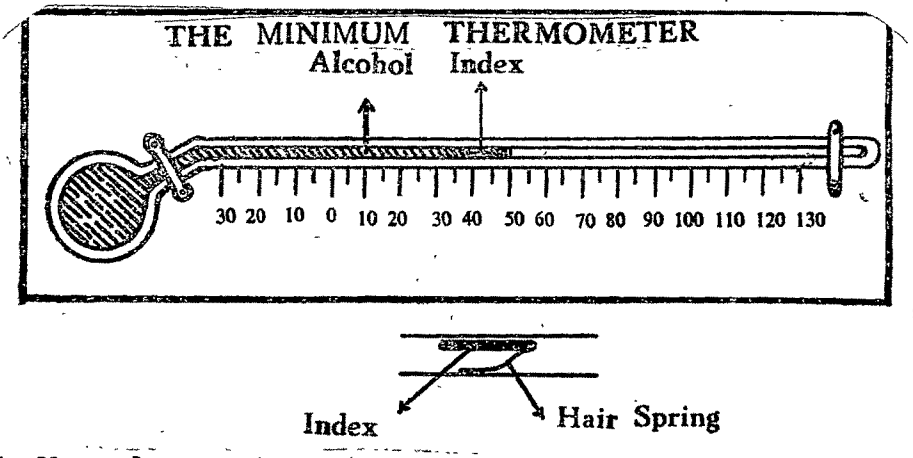
---

124. The maximum temperature of the day is recorded by the lower end of the index.

---

125. The minimum thermometer records the minimum temperature of the day.

Below is given a diagram of the minimum thermometer. Observe the figure carefully.



The bulb and a part of the stem are filled with alcohol.

---

126. The steel index is inside the alcohol.

127. As the temperature of the day falls, the level of alcohol falls.

128. The scale extends below the 0°F on the lower side of the scale.

129. So, can the minimum thermometer records temperature below 0°F? Yes

130. The index is provided with a hair spring.

131. The steel index of the minimum thermometer is placed inside the alcohol.

132. The steel index can move downwards only.
Can the index move upwards? No

133. When the temperature rises, alcohol expands and moves upwards in the stem.

134. The index will not move upwards.

135. When alcohol expands and moves upwards, the steel index doesn't move.

136. The steel index does not move when the alcohol expands.

137. When the temperature rises, alcohol expands and moves Upwards.

138. The index is provided with a special part called the hair spring.

139. The hair spring prevents the index from moving upwards.

140. So when the alcohol expands and moves upwards, the steady position of the index is not changed.

141. When the temperature falls, alcohol contracts and moves downwards.

---

142. When alcohol moves downwards, it drags the steel index downwards along with it.

---

143. When the minimum temperature is reached, alcohol stops moving downwards. And steel index also stops moving.

---

144. The upward movement of the steel index of the minimum thermometer is prevented by the hair spring.

---

145. Tickmark _/ shows the correct answer.

When alcohol expands and moves upwards, the steel index :

(i) moves upwards ( )
(ii) moves downwards ( )
(iii) does not move (_/)

---

146. Tickmark _/ shows the correct answer.

When alcohol contracts and moves downwards, the index :

(i) moves upwards ( )
(ii) moves downwards (_/)
(iii) does not move ( )

---

147. The minimum temperature of the day is recorded by the upper end of the index.

---

148. Tickmark _/ shows the correct answer :

The part that records the minimum temperature of the day is :

(i) the level of alcohol ( )
(ii) upper end of the index (_/)
(iii) lower end of the index ( )

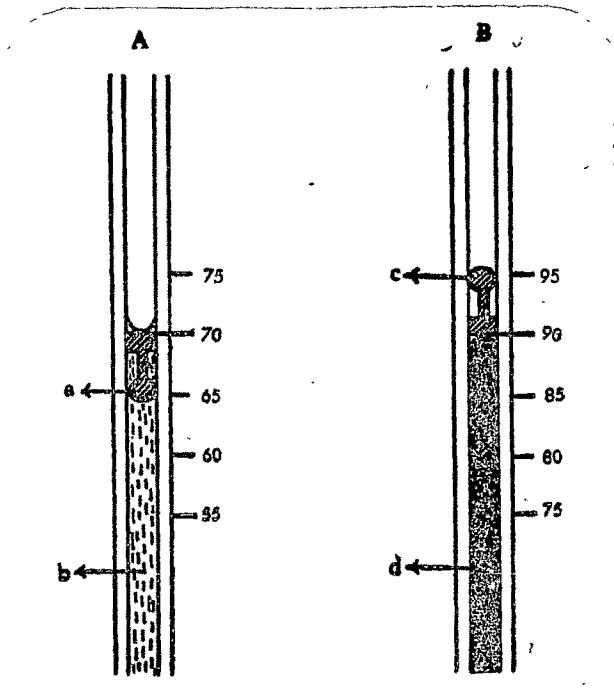
---

149. Before using the maximum or minimum thermometers a second time, the position of the steel index is to be adjusted using a small magnet (magnet attracts steel).

---

150. Using a magnet, the index of the minimum thermometer is to be brought inside the alcohol.

151. In the figure, the position of the indices of maximum thermometer and minimum thermometer are given. Observe the figure carefully.



a. The figure A shows the minimum thermometer.
b. The figure B shows the maximum thermometer.

152. In the minimum thermometer the index is inside the alcohol.

153. In the maximum thermometer the index is above the mercury.

154. The upper end of the index in the minimum thermometer is at 70°F.

155. The lower end of the index in the maximum thermometer is at 90°F.

156. 90°F indicates the maximum temperature of the day.

157. Minimum temperature of the day is 70°F.

158. Maximum temperature is recorded by the lower end of the index.

159. Tickmark _/ shows the TWO special parts of the maximum and minimum thermometers not found in common thermometers :

(a) Scale ( )

(b) Glass tube ( )

(c) Hair spring (_/)

(d) Bulb ( )

(e) Index (_/)

(f) Mercury ( )

---

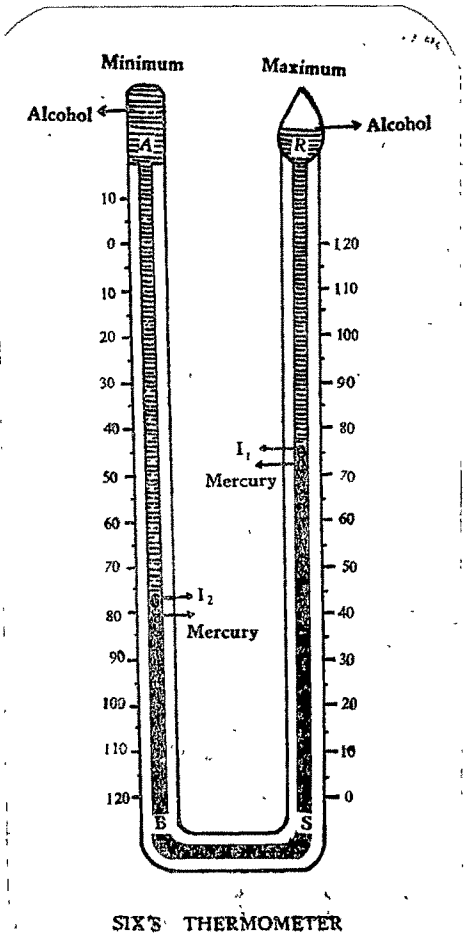
160. Below is given a table comparing the maximum and minimum thermometers. Column I gives the points of comparison and alternative answers. Columns II and III show the correct words selected from the brackets in Column I.

I Points of comparison	II Maximum thermometer	III Minimum thermometer
1. Liquid used is (alcohol/ mercury).	mercury	alcohol
2. Index is (above/inside) the liquid.	above	inside
3. Index moves (downwards/ upwards).	upwards	downwards
4. Temperature of the day is recorded by this end of the index (lower end/ upper end).	lower end	upper end
5. Index moves when the liquid (falls/rises)	rises	falls

161. So far we have studied the maximum and minimum thermometers separately. We have a combined thermometer called Six's Thermometer, which records both the maximum and minimum temperature of a day.

---

162. Observe the figure of Six's thermometer carefully.



SIX'S THERMOMETER

(a) Six's thermometer consists of a U shaped glass tube.

(b) Six's thermometer contains the liquids alcohol and mercury.

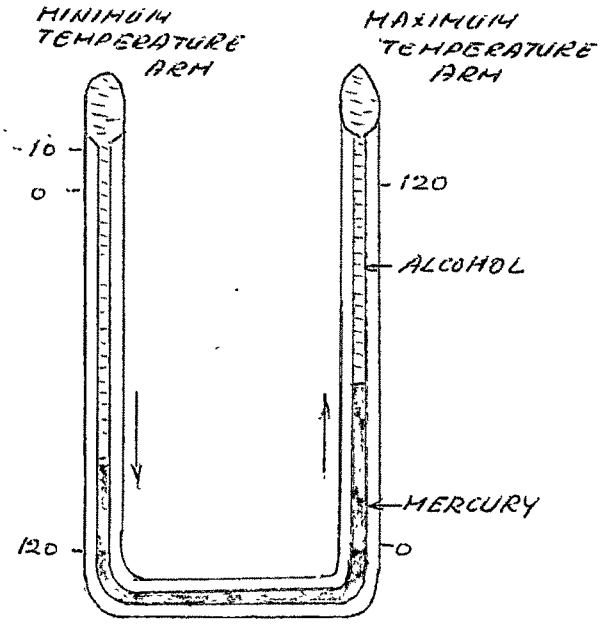
(c) It has two arms one for recording the maximum temperature and the other for recording the minimum temperature of the day.

(d) There is a vacuum in the arm carrying the maximum temperature scale.

(e) The maximum temperature scale starts from the bottom while the minimum temperature scale starts from the top.

---

163. Observe the figure carefully.



When the temperature rises, the mercury and alcohol expand and mercury moves upwards in the maximum temperature arm.

---

164. Both the maximum and minimum temperature arms of the Six's thermometer are connected.

---

165. The mercury in Six's thermometer can flow from one arm to the other.

---

166. When the temperature rises, alcohol and mercury expand and move upwards in the maximum temperature arm. So mercury level rises in the maximum temperature arm.

---

167. When the temperature rises, mercury level rises in the maximum temperature arm.

---

168. When the mercury level rises in one arm, it falls in the other arm. With rise in temperature, mercury level rises in the maximum temperature arm. Mercury level in the minimum temperature arm falls.

---

169. The index in the maximum temperature arm is above the level of mercury.

---

170. The mercury while expanding pushes the index upwards till the maximum temperature is reached.

---

171. When the maximum temperature is reached, the mercury does not rise further.

So at the maximum temperature the index remains steady.

---

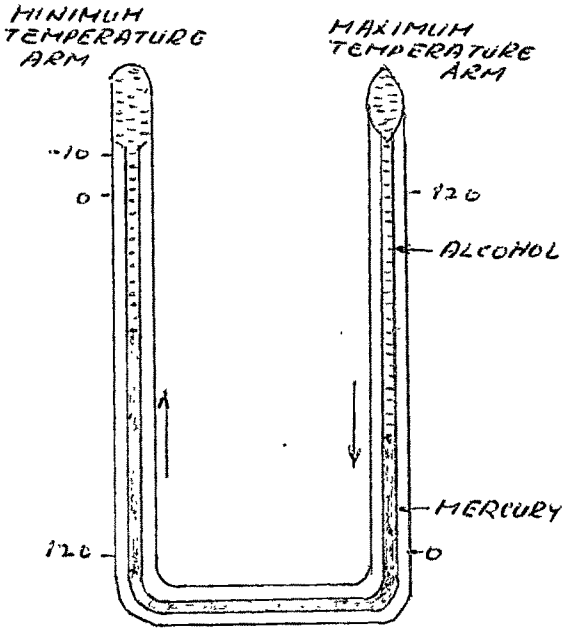
172. Steel index does not move from its steady position because it is prevented by the hair spring.

---

173. The scale of the maximum temperature arm starts from the bottom. So higher the position of the index, higher will be the temperature of the day.

---

174. Observe the figure carefully.



When the temperature falls, the level of mercury <u>falls</u> in the maximum temperature arm.

175. When the temperature falls, the mercury and alcohol contract.

176. When the temperature falls, the level of mercury <u>falls</u> in the maximum temperature arm.

177. Level of mercury rises in the <u>minimum</u> temperature arm.

178. The mercury in the minimum temperature arm moves upwards and pushes the <u>index</u> upwards.

179. When the temperature falls, the index in the minimum temperature arm moves upwards.

180. When the minimum temperature is reached, the index <u>remains steady</u>.

181. Minimum temperature can be noted even after sometime because the index remains steady.

---

182. The scale in the minimum temperature arm starts from the top. So higher the position of the index, lower will be the temperature.

---

183. In the Six's thermometer both the indices are above the level of mercury.

---

184. In Six's thermometer both the indices are pushed upwards by mercury.

---

185. The index in the maximum temperature arm is pushed upwards when the mercury expands.

---

186. The index in the minimum temperature arm is pushed upwards when the mercury contracts.

---

187. The temperature scale in the minimum temperature arm starts from the top.

---

188. (a) Six's thermometer is a U shaped thermometer.

(b) How many indices are there in the Six's thermometer? 2 or two.

(c) What are the liquids used in the Six's thermometer? mercury, alcohol.

(d) In Six's thermometer, both the indices are pushed by mercury.

(e) In Six's thermometer, the maximum temperature scale starts from the bottom while the minimum temperature scale starts from the top.

(f) In Six's thermometer, both the indices move upwards.

189-A. Clinical thermometer is used to record the temperature of human body while Six's thermometer records the maximum and minimum temperatures of the day.

In the figure given below the parts of the clinical thermometer are marked by the different letters :

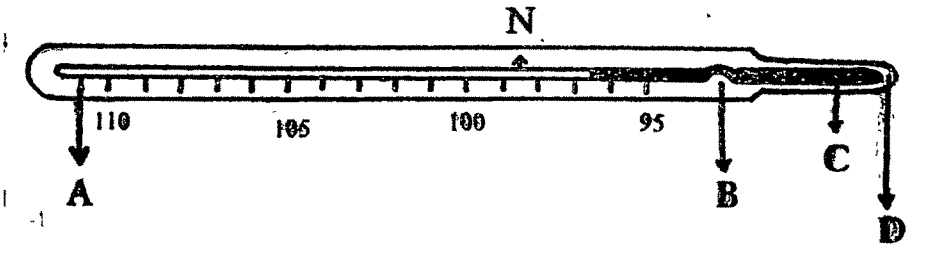
Part A : Shows the stem of the thermometer.

Part B : Shows the bent called constriction.

Part C : Shows mercury used in the thermometer.

Part D : Shows the bulb which is filled with mercury.

Part N : The arrow at N (98.4°F) shows the normal body temperature.



Observe the figure and try to recognize the names of the parts. Now go to B part of this page.

189-B. Given below are the parts of the clinical thermometer. Observe the figure given above carefully and know which part is marked by which letter in the figure.

1. Bulb is marked by the letter D.
2. Mercury is marked by the letter C.
3. Constriction is marked by the letter B.
4. Normal body temperature is marked by the letter N.
5. The value marked at N is 98.4°F.
6. The stem is marked by the letter A.

---

190. In order to measure the body temperature of the patient, the bulb of the clinical thermometer is put under the tongue or in the arm pit of the patient.

---

191. The mercury expands and moves upwards due to the rise in the body temperature of the patient.

---

192. The special bent part above the bulb of the clinical thermometer is called the constriction.

---

193. The constriction allows the mercury to pass through it in the upward direction only.

The constriction does not allow the mercury to move in the downward direction.

---

194. In most of the thermometers there is a special part at the lower end of the thermometer called the bulb.

---

195. The bulb of the clinical thermometer contains mercury.

---

196. There is a special bent in the clinical thermometer called the constriction. The constriction is above the bulb.

---

197. Constriction does not allow the mercury to move downwards.

---

198. So when the clinical thermometer is removed from the body, the mercury does not move downwards because it is prevented by the constriction.

---

199. The body temperature of a patient is indicated by the steady position of the mercury.

---

200. When the patient has fever, the steady level of mercury above the constriction indicates his body temperature.

---

201. After recording the temperature of a patient, the clinical thermometer should be shaken in order to bring the mercury downwards.

---

202. If the clinical thermometer is washed with water above 110°F, the mercury in the thermometer expands to that high temperature and forces through the glass and breaks the thermometer.

---

203. The temperature of boiling water is 212°F.

---

204. The stem of the clinical thermometer is graduated upto 110°F.

---

205. The maximum temperature to which the mercury in the clinical thermometer can expand in it is lower than the boiling point of water.

---

206. So when the clinical thermometer is washed with the boiling water which is at 212°F, the mercury expands too much. This breaks the clinical thermometer.

---

207. Therefore clinical thermometer should be washed with cold water.

---

208. The following sentences are completed by selecting the correct words from the list given below :

WORDS: magnet, index, bulb, hair spring, arrow, contriction, vacuum.

(a) The thermometer would burst at higher temperature if there is no vacuum above the mercury in the thermometer.

(b) The steel index is prevented from moving by the hair spring.

(c) The back flow of mercury in clinical thermometer is prevented by the contriction.

(d) The index is reset using a small magnet.

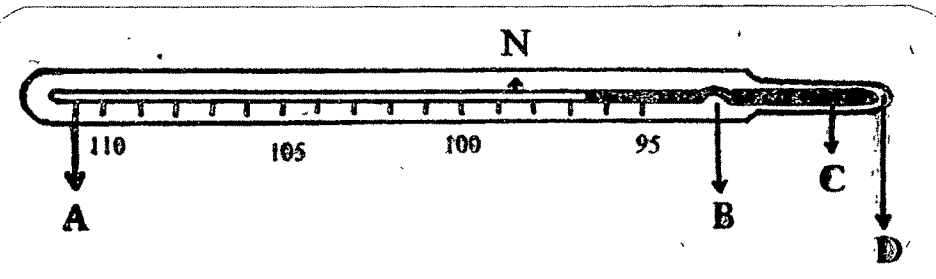
(e) In the Six's thermometer the temperature of the day is indicated by the index.

(f) To measure the temperature of water, the bulb of the thermometer is immersed in it.

(g) Normal body temperature (98.4°F) is shown in the clinical thermometer by the arrow.

---

209. Below is given the diagram of clinical thermometer. Some parts of it are marked by A, B, C, D and N.



(1) Part A is the stem.

(2) Part B is the constriction.

(3) Part C is the mercury.

(4) Part D is the bulb.

(5) Arrow indicates the normal body temperature.

(6) N is at the temperature of 98.4°F.

Some interesting things about thermometers :

* Galileo at the end of 16th century prepared a water thermometer (the first thermometer).

* Amonton discovered that water always boiled at the same temperature at sea level.

* Fahrenheit discovered mercury to be the most suitable thermometric liquid. He constructed a mercury thermometer called Fahrenheit thermometer.

* Celsius constructed the Centigrade thermometer.

Answer the following :

(a) The use of mercury was discovered by .....

(b) The first thermometer was constructed by .....

Answers

(a) Fahrenheit
(b) Galileo
(c) Celsius
(d) Amonton

(c) Centigrade thermometer was constructed by .....

(d) Steady boiling point of water was discovered by .....

Answers are given on the left side of this page.

NOW THE PROGRAMME IS OVER