Annexure

Annexure 1

Department of Education [CASE]
Faculty of Education and Psychology
The M S University of Baroda, Vadodara

ACHIEVEMENT TEST

Dear student,

I am a research scholar in the Faculty of Education and Psychology, The M. S. University of Baroda, Vadodara. I am doing my doctoral work under the guidance of Dr. R. C. Patel, Reader in Education, Faculty of Education and Psychology, The M. S. University of Baroda, Vadodara. The title of my study is "Development and implementation of an Activity Based Science Teaching Programme for pre-service student teachers". This test which is based on secondary school science curriculum and is a part of the requirement of my doctoral work is being conducted for knowing your understanding about some of the concepts in science.

The responses given by you will be used only for the Ph.D. work and kept confidential.

I am thankful for responses.

Guide
Dr. R C Patel

Research Scholar
Jyotsna Amin

Basic information about the student

Name of the student :

Sex :

Age in years :

Educational qualification:

Medium of Instruction at school level:

ACHIEVEMENT TEST

Read the situations carefully and think about your plan of action for every item. The questions are based on the situations or diagrams. You have to select the proper response from the given options and encircle the index letter of the response you choose. Questions or the situations are based on the secondary science curriculum and concept from the science and technology text books of standard: VIII and IX.

1. You put a kettle on a gas-stove. Heat is transferred from the burner to the kettle by the process of
   A. conduction B. convection C. radiation D. absorption

2. The exhaust from heavy vehicles can form acid rain through the following reaction: nitrogen dioxide gas (NO_2) created in the vehicle engine mixes with water vapour (H_2O) in the air to form nitric acid (HNO_3) and nitrous acid (HNO_2). The products in this reaction are:
   A. nitrogen dioxide and water vapor B.nitric acid and nitrous acid
   C. water vapor and nitric acid D.nitrogen dioxide and nitric acid

3. Throughout the day, you observed a number of bees collecting nectar from the wildflowers. You recalled that bees are a species that have several forms adapted to specialized functions within their community. Another example of a species that has specialized functions is
   A. frogs B. ants C. snakes D. dragonflies

4. Which type of chemical reaction is taking place when we add glucose into water?
   A. Exothermic B. Endothermic
   C. Isothermic D. Geothermic

5. We require the telescope in order to see the three of the planate of the solar system. Identify the right group from the given
   A. Jupiter, Neptune and Venus B. Mars, Jupiter and Venus
   C. Pluto, Uranus and Saturn D. Uranus Neptune and Pluto

6. You know that Venus is visible in the night sky because it
   A. reflects light B. refracts light
   C. emits light D. produces light

7. Your friends collected rocks from a lake to build a perimeter for the fire pit. They noticed that the rocks weren't as heavy while they carried them partially submerged in the water. This is because of the
   A. mass of the rock B. density of the water
   C. buoyant force of the water D. buoyant force of the rock

8. Your science teacher explains you about a unique relationship that exists between the monarch butterfly and the viceroy butterfly. Because the monarch butterfly tastes bitter when eaten by a predator, predators are discouraged from eating other monarch butterflies. The viceroy butterfly has adapted to have similar coloration as that of the monarch butterfly. This adaptation of the viceroy butterfly is an example
   A. mimicry B. parasitism C. mutualism D. polymorphism

9. While looking up at the night sky, you remember that an object that emits its own light is called
   A. a moon B. a star C. a planet D. an asteroid

10. While working in the laboratory your lab assistant has mixed the permanent slides of animal cells and plant cells. To discriminate the animal cell from the plant cell, he should see the
    A. presence of chloroplast and centrosomes
    B. absence of chloroplast and centrosomes
    C. absence of chloroplast and presence of centrosomes
    D. presence of chloroplast and absence of centrosomes

11. A primary class boy while playing with a pencil put it into a half filled glass of water which was transparent. He was surprised to observe that pencil appeared to be broken at the surface separating water and air. His science teacher explained that it was due to
    A. refraction B. reflection C. dispersion D.surface tension

12. Which unit system is not a metric unit system?
    A. FPS system B. SI system C. MKS System D. CGS system

13. In your village farm your field workers complains that there are plenty of weeds growing in the farming area which can affect the crop production. You contacted the agricultural inspector in your town and he suggested that for the crop protection you should use
    A. Fungicides B. Insecticides C. Rodenticides D. Herbicides

14. The LPG gas which is used in the kitchen as a fuel consists liquid butane which is colorless and odorless. In order to avoid accident in the case of gas leaking from cylinder, one more gas having bad odor is added in little amount namely
    A. Ethyl mercapton B. Ethylene mercapton
    C. Methyl mercapton D. Butyl mercapton

15. Four possible test results of the litmus test for a liquid are given below:

	Indicator	Final colour
Test 1	Red litmus	Blue
	Blue litmus	Blue
Test 2	Red litmus	Blue
	Blue litmus	Red
Test 3	Red litmus	Red
	Blue litmus	Blue
Test 4	Red litmus	Red
	Blue litmus	Red

    Which test result is true for water?
    A. Test 1 B. Test 2 C. Test 3 D. Test 4

16. You are asked to find out the p block in the modern periodic table you will look into the
    A. blocks 1 and 2 of the periodic table
    B. blocks 13 to 18 of the periodic table
    C. blocks 3 to 12 of the periodic table
    D. block places below the periodic table

17. The ethylene glycol (antifreeze) used by the mechanic is produced when ethylene is reacted with oxygen and water. Which of the following word equations describes this reaction?
    A. Ethylene glycol → water + oxygen + ethylene
    B. Water + oxygen → ethylene + ethylene glycol
    C. Oxygen + water + ethylene → ethylene glycol
    D. Ethylene + water → ethylene glycol + water

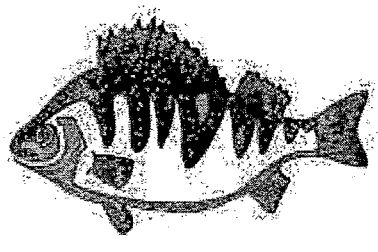
18. Your chemistry teacher writes the following equation ns on the black board.
    $CuSO_4 + Mg \longrightarrow MgSO4 + Cu$
    $CuSO_4 + Zn \longrightarrow ZnSO4 + Cu$
    These are the examples of
    A. Decomposition B. Substitution
    C. Rearrangement D. Neutralization

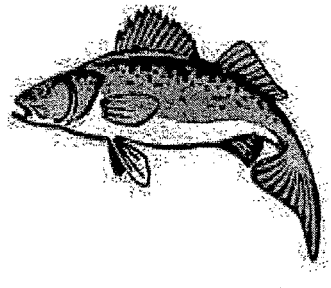
19. A box containing three identical sealed jars slipped from your hands and fell into the water. One jar contained 500 cc of crushed salt, one contained 500 cc of sugar, and one contained 500 cc of baking soda. Each jar floated at a different height because of its contents'
    A. density B. volume C. composition D. viscosity

20. Deficiency disease is the disease which occurs because of some deficiency of nutritional component. Which of the following is not deficiency disease?
    A. xerophthalmia B. anemia C. goiter D. AIDS

21. While cutting the vegetable your mother has injured/cut her finger. While applying iodine on the wound iodine drop falls on the potato and it was converted into blue-black coloration, which tells about
    A. The presence of starch B. The presence of vitamins
    C. The absence of protein D. The Absence of starch

22. The stream empties into a lake. Within the lake, you observe two different species of fish. The process most likely responsible for the development of different species of fish is

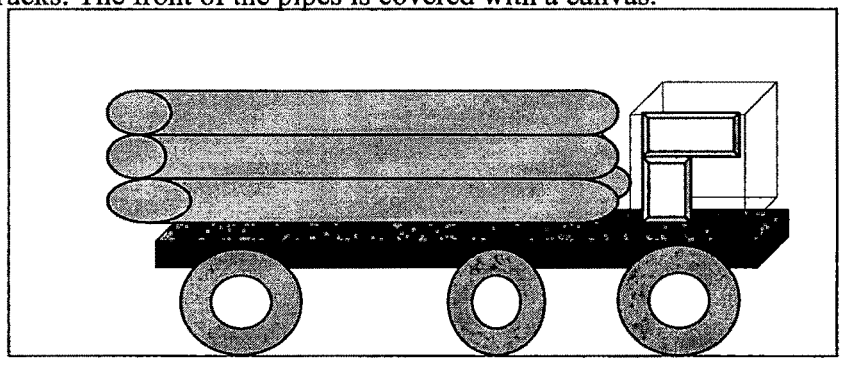




    A. artificial selection B. artificial breeding
    C. selective breeding D. natural selection

23. The resort situated near by home wants to compost its biodegradable waste products. Which of the following groups of items includes only biodegradable waste products?
    A. Egg shells, vegetable peelings, milk cartons, and newspapers
    B. Egg shells, vegetable peelings, soup cans, napkins, and apple peels
    C. Vegetable peelings, cardboard boxes, water bottles, and egg shells
    D. Vegetable peelings, apple peels, corn waste and egg shells

24. The long, narrow pipes used to drill for natural gas are loaded on flatbed trailer trucks. The front of the pipes is covered with a canvas.



This increases the fuel efficiency of the truck because it limits the movement of air through the pipes, thus reducing the

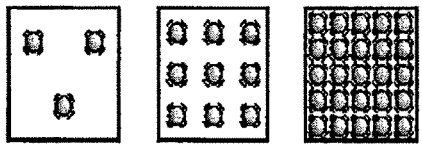
A. viscosity of the air within the pipes
B. air resistance within the pipes
C. air pressure on the truck
D. weight of the truck

25. In 1932 American chemist Harold Urey discovered atom of the hydrogen whose atomic weight was 2 instead of 1. Later on another atom of hydrogen having atomic weight of 4 is also discovered. They are labeled as deuterium and tritium. We know about the hydrogen having atomic weight one. All these three are known as isotopes because,

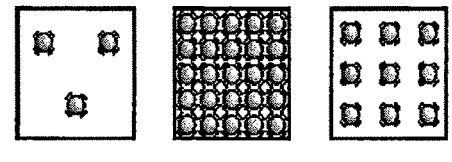
A. same proton and same electron in it
B. same proton and different neutron in it
C. different proton and same neutron in it
D. different proton and different neutron in it

26. Your father uses a metal pot to boil some water. The metal pot heats quickly, and then transfers its heat to the water. The water, in turn, transfers the heat to the air surrounding the pot. The particles in the pot, water, and air collide against each other during the heating process. Which of the given sets of diagrams best represents the spacing of particles in the metal pot, the water and the air, respectively?

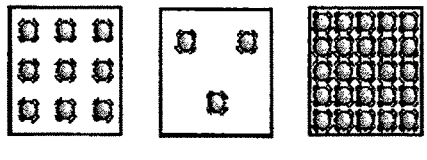
A.



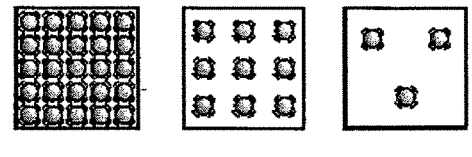
B.



C.



D.

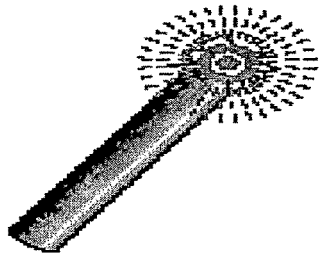


27. The structures of a bird that have the same function as rudders on a plane are

A. curved wings
B.pointed beaks
C. strong muscles
D. tail feathers

28. The hydroelectric power plant has to change the amount of energy it produces in order to supply the new town with electricity. This can be done by
    A. increasing the rotational speed of the generators
    B. decreasing the pressure of the water behind the dam
    C. increasing the diameter of the pipe carrying the water through the dam
    D. decreasing the speed of the water as it goes through the generator

29. During your adventurous tracking you went to a river with your friends, the trainer gives you a sodium flame to help you see better during your dive. You know that a reaction between the sodium and the water will cause the flame to glow brightly.



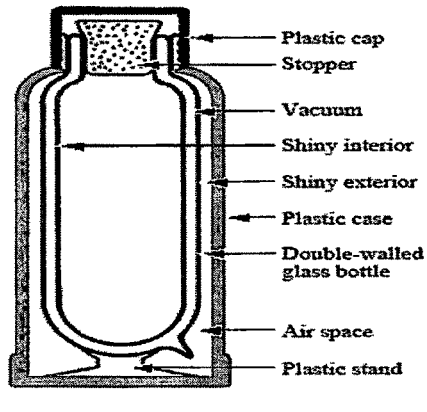
    The reaction that occurs between the sodium and the water is an example of a
    A. physical change in which energy is absorbed
    B. physical change in which energy is released
    C. chemical change in which energy is absorbed
    D. chemical change in which energy is released

30. what assumption are you making when you run hot water over a metal id on a glass jar to loosen the lid
    A. both the glass jar and metal id increase in the size in the same proportion
    B. the glass increases in size in a greater proportion than the metal lid
    C. the metal lid increases in size in a greater proportion than the glass jar
    D. glass and metal do not stick together as much in water

31. At the end of the day, you have a hot drink from your thermos. A cross section of the thermos is shown below.

    Which of the following statements best explains why the drink remains hot in a thermos?

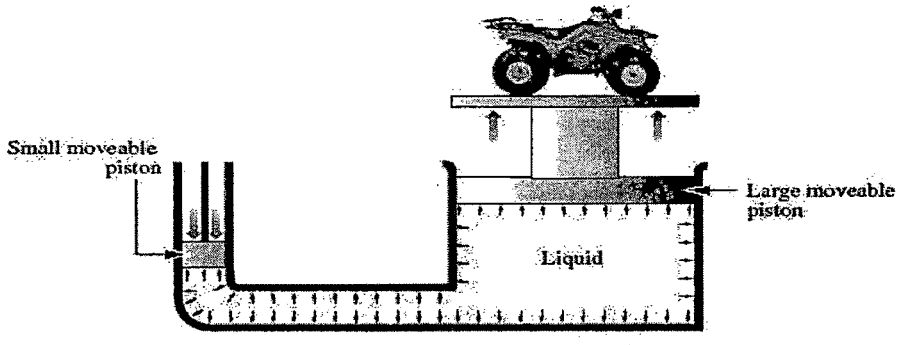
    A. Air is a good conductor of heat.
    B. Plastic does not conduct heat well.
    C. A vacuum is a poor conductor of heat.
    D. Shiny surfaces do not reflect heat well



32. Which group of atoms is having 6 electrons in their outermost orbits in a given set?
    A. oxygen and phosphorous
    B. sodium and potassium
    C. chlorine and fluorine
    D. oxygen and sulphur

33. Your friend met with an accident and requires blood. His blood group is B. Which group donor can donate blood to your friend?
A. B only B. AB and O C. AB only D. O and B

34. To service a vehicle the mechanic uses a hydraulic hoist to lift it up. The diagram below models how a hydraulic hoist works. To lift a vehicle, a hydraulic hoist must create an upward



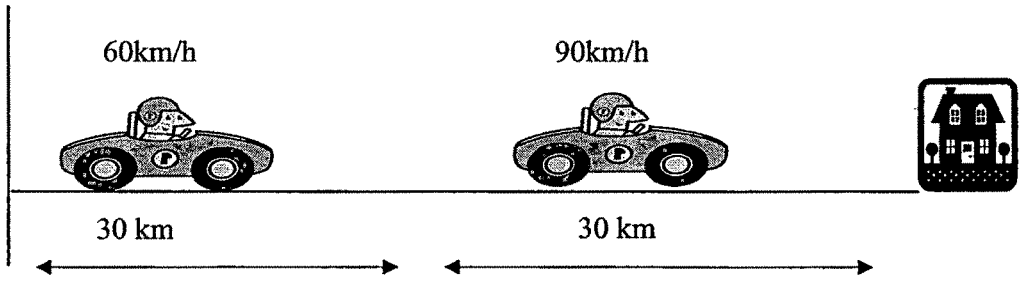
A. force equal to the downward force of the vehicle
B. force greater than the downward force of the vehicle
C. pressure less than the downward pressure of the vehicle
D. pressure greater than the downward pressure of the vehicle

35. While playing with a post card your younger sister has inserted a pencil and made a small hole in it. You told her to put a drop of clear water on the hole. You kept approximate 2 cm distance from a newspaper and told her to read the letters .The letters were amazingly magnified because the spherical surface of the drop worked as
A. convex mirror B. concave lens C concave mirror D. convex lens.

36. About an hour after you finish your dinner, you start experiencing pains in your stomach. You conclude that you have acid indigestion. To best neutralize the excess acid being produced, you should eat something
A. acidic B. salty C. basic D. fatty

37. On a sunny winter day, which vehicle would be the warmest to the touch?
A. A blue car B. A red car C. A white car D. A block car

38. You are in hurry to reach to your home but you missed your bus thus, traveling by a car. The car travels first 30km of its journey on express highway at 60km/h and next 30km at 90km/h uniform speed. Hence you reach home earlier than the expected time; your mother was asking you about the average speed of your car. You said that the average speed of the car was

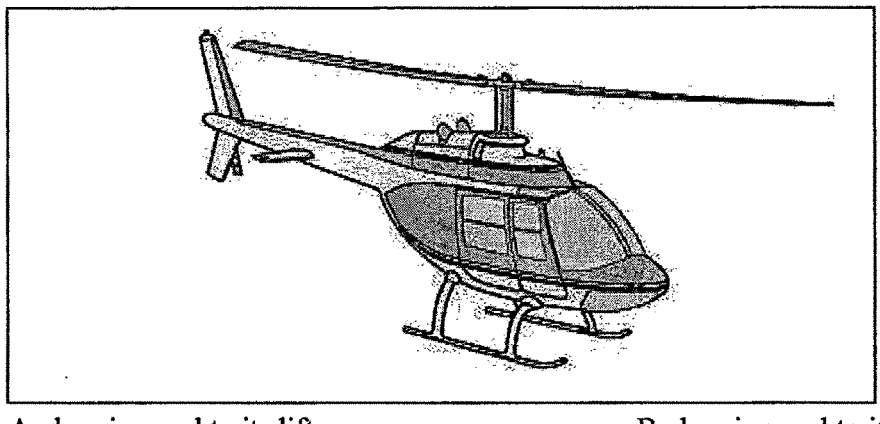


A. 60 km/h B. 99 km/h C. 72 km/h D. 75 km/h

39. Your teacher explains that in order for plants to produce their own food through the process of photosynthesis, they require
A. chlorophyll and release oxygen
B. chlorophyll and release nitrogen
C. water vapour and release carbon dioxide
D. nitrogen and release water vapour

40. Resources such as solar energy, air, water and tide-energy of sea are available in unlimited quantities and are not exhausted by human activities. They are called as
A. inexhaustible natural resources
B. exhaustible natural resources.
C. non renewable natural ressources
D. renewable natural resources

41. Near the helipad school you saw a helicopter hovering around. One reason why a helicopter is able to hover is because its



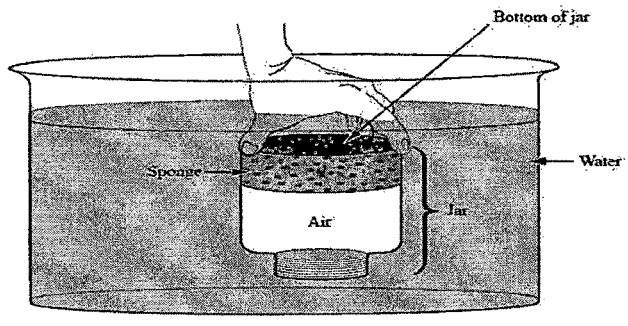
A. drag is equal to its lift
B. drag is equal to its gravity
C. lift is equal to its gravity
D. thrust is equal to its lift

42. Use of a drill to make a hole in the wall is an example of converting
A. thermal energy to mechanical energy
B. thermal energy to electrical energy
C. electrical energy to thermal energy
D. electrical energy to kinetic energy

43. During your dive, you are amazed by the number and variety of organisms you see. You notice a bottom-dwelling animal that has long feathery arms. Floating among the arms of this animal are dead plant and animal debris. In order to collect food, this animal has adaptations that allow it to
A. increase its surface area to carry out photosynthesis
B. helps it withstand the cold water temperatures
C. create water currents toward its mouth
D. increase its surface area to allow for more transpiration

44. you know that gravitational force acting on a body at a given location is it's weight at that location and thus weight is the product of mass and local value of 'g' is least
A. on poles.
B. on the top of Himalaya
C. on 45^0 latitude
D. on equator

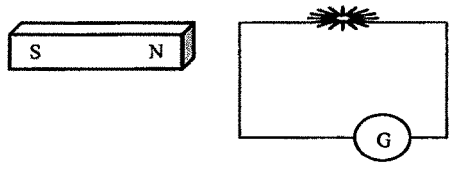
45. You friend is performing an experiment which involves a jar and a sponge. He wedged a sponge into the bottom of an open jar. Then he turned the jar upside down and held it in a container of water.



Which of the following statements explains why the sponge did not get wet?

A. The air in the jar exerts pressure on the water
B. The sponge is lighter than the air
C. The sponge does not absorb water
D. The air is denser than the sponge

46. If we connect a galvanometer with a conducting coli as shown in figure in figure and bring a bar magnet rapidly towards the coil the galvanometer shows deflection. This is happening because of



A. electric current
B. electromagnetic induction
C. magnetic induction
D. none of the above

47. Your teacher explains how living things can be grouped according to their characteristics. The characteristics of some kingdoms are listed in the chart below.

	Kingdom			
Characteristic	**Animalia**	**Plantae**	**Monera**	**Protista**
Unicellular			✓	✓
Multicellular	✓	✓		
Has a non-cell nucleus			✓	
Has a cell nucleus	✓	✓		✓
Makes food through photosynthesis		✓		
Obtains food from other organisms	✓			✓
Is capable of locomotion	✓			✓

An organism that is multicellular, capable of locomotion, and incapable of photosynthesis belongs to which kingdom?

A. Protista B. Animalia C. Plantae D. Monera

48. In the science practical exam you are asked to identify the object which was from dicotyledon class in a given set of plants. Which is the correct plant from the followings?

A. fern B. sunflower C. cycus D. maize

49. If we observe the forest eco-system in the light of nutritional tropic level, who will form the first tropic level or primary consumer?
    A. insects, rabbits, dear and herbivoures
    B. green plants and hemosynthetic bacteria
    C. frogs and other small carnivores
    D. tiger, snakes-large carnivores

50. Which of the following could be observed with the sense of sight?
    A. A change in temperature of the air
    B. A change in heights of the plants
    C. A change in sweetness of new chemical
    D. A change in the noise made by an engine

Annexure 2

Science Pedagogy Questionnaire

Dear respondent,

I am a research student in the faculty of education and psychology, The M. S. University of Baroda, Vadodara. I am pursuing my doctoral research under the guidance of **Dr. R. C. Patel**, Reader in Education, Faculty of Education and Psychology, The M. S. University of Baroda, Vadodara.The title of my study is "Development and implementation of an **Activity Based Science Teaching Programme** for pre-service student teachers."
The test which is a part of my doctoral work is being conducted for knowing your understanding about science teaching and learning. The responses given by you will be used for the Ph.D. work only and kept confidential. Your genuine and fair responses are necessary for the proper diagnosis and producing real picture of the field.

I am thankful for responses. Ms. Jyotsna A. Amin

Name:

Roll No :

Date:

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1) What is science?

2) Do you believe that one should learn science? Justify your response.

3) Should science be a compulsory subject at secondary level? Justify your answer.

4) Did you enjoy learning of science?

5) What are the different ways through which we can learn science?

6) Do you think that science develops certain skills and qualities in students? If yes, mention them.

7) Were you given any assignment by your science teacher when you were in secondary classes? If yes, specify.

8) Do you think that science should be taught through lecture method? Justify your answer.

9) If you were a science teacher in grade VIII and asked to teach a topic, **'sources of energy'**;
   a) How will you introduce this topic?

   b) How will you teach this topic?

   c) What will you do to make the topic more interesting?

d) How will you summarize your teaching?

e) What kind of assignment you will give to your students?

f) How will you evaluate the learning of your students?

g) Apart from the method you have adopted, what are the alternative ways through this topic can be taught?

10) What do you expect from your students after teaching them about **'solar energy'** in terms of behavioral changes?

11) If you were a science teacher in grade VIII and asked to teach a topic, **'reflection'**
   a) How will you introduce this topic?

b) How will you teach this topic?

c) What will you do to make the topic more interesting?

d) How will you summarize your teaching?

e) What kind of assignment you will provide to your students?

f) How will you evaluate the learning of your student?

g) Apart from the method you have adopted, what are the alternative ways through this topic can be taught?

12) What do you expect from your students after teaching them about **reflection** in terms of behavioral changes?

13) What is '**Scientific Attitude**'?

14) What is '**Scientific Method**'?

Annexure 3.1

Performance Based Test

This test is prepared to evaluate the experimental skills of student teachers of B.Ed. opted science and technology as one of the method of teaching at secondary school level.

- ❑ To achieve this objective observation technique will be used.
- ❑ Every Student will be asked to prepare one activity to explain any one concept based on secondary science textbooks.
- ❑ They will be procuring the requirements in advance and one decided day they will be performing it in front of the peer group one by one.
- ❑ While they are performing the activity, evaluators (minimum three) will be there to judge them.
- ❑ To maintain consistency in evaluation while observing certain criteria have thought of by the researcher which are given below. Every criterion contains ten marks.
- ❑ Students will be assigned mark out of ten according to their performance for each criterion.
- ❑ Below are the criteria and brief description of them.

Criteria of Evaluation of Experimental skills

1. **Selecting the activity:** In accordance with the topic selected from secondary science text book and suitability of the activity to explain the concept selected by the students.

2. **Proportionality:** In order to explain the particular concept whatever equipments/ materials and solutions the students are using whether they are in proportion or not. Even the apparatus or any materials used for the activity, its shape/ size/volume in accordance with the requirement.

3. **Accuracy:** The way students handle the apparatus/materials /solutions whether it is with due care or accuracy? Cleanliness maintained while performing the activity and dealing with materials.

4. **Arrangement:** While performing the activity how the student is arranging the apparatus and materials whether it is visible to the students or not.

5. **Presentation skill:** It includes the Logical flow and sequence of the oral presentation and performance, way of presenting, clarity of concept and confidence which one is having while performing the activity.

- ❑ **Considering the above criteria each student will be given marks out of 50.**

Annexure 3.2

Rating Scale for assessing the Performance of student teachers

C : 507 : Teaching of Science, B.Ed.(2009-2010) 21.07.2009

Sr. No.	Roll No.	Name of student	Name of the Topic	Selecting the activity(10)	Proportionality (10)	Accuracy (10)	Arrangement (10)	Presentation skill (10)	Total 50
1	1	Abita Kumari							
2	2	Juhi Agrawal							
3	6	Anjali Singh							
4	11	Bhatt Jignasa D.							
5	17	Brahmbhatt Arpita M.							
6	31	Choudhari Komal J.							
7	36	Dhal Nilofar Ibrahim							
8	38	Doctor Sheral Oliver							
9	40	Dwivedi Ruchi							
10	41	Gadariya Archana P.							
11	51	Gorasia Viral V.							
12	59	Karimalikkal Priya P.							
13	60	Bhagyashree M.							
14	62	Kothari Dipti Vijay							
15	65	Kureshi Altafhusen H.							
16	67	Ledwani Aarti Indarlal							
17	68	Likhitkar Priyanka M.							
18	70	Mahisuri Roshni S.							
19	73	Malviya Manjula J.							
20	77	Mistry Piyush Ratilal							
21	79	Nair Shobha T K Kesavan							
22	80	Nair Trupti Velukutty							
23	81	Nambiar Vandana V.							

24	90	Pandey Sangita Abpandey							
25	92	Parekh Birju Madhusudan							
26	108	Patel Ankita Gamanbhai							
27	116	Patel Vasima Iqbal							
28	117	Patel Yoginabahen R.							
29	119	Pillai Lakshmi S.							
30	124	Prajapati Rashmi B.							
31	125	Prajapati Seemaben T.							
32	126	Prajapati Sunitaben K.							
33	132	Rami Jyotiben H.							
34	135	Rana Monali Kanubhai							
35	142	Raulji Atishsinh B.							
36	143	Patel Neha							
37	146	Shah Bijal Rasesh							
38	149	Shah Minal Ashokkumar							
39	152	Shrivastava Shilpa R.							
40	155	Sharma Shilpa Netrapal							
41	169	Upadhyay Manisha Sanjiv							
42	172	Poonam Kumari							
43	179	Vinchurkar Sonal M.							

Name of the Evaluator:

Signature:

Date:

Annexure 4

Nature of Science Scale

This scale is prepared to know your views about nature of science and understanding about various products as well as processes of science. There are total fifty statements in this scale having five point rating scale. Fore each statement given below put a tick mark (√) below choosing the option which best indicates your view point.

SA: Strongly Agree **D**: Disagree **UD:** Undecided/Neutral **D**: Disagree **SD:** Strongly Disagree

Name of the student: **Date:**
Roll No.

Sr. No.	**Statements**	**SA**	**A**	**UD**	**D**	**SD**
1	A blind guess about the results of an experiment, prior to its execution is the hypothesis.					
2	A man with scientific attitude is impartial and unbiased in his judgments					
3	A person worshiping god cannot be scientific.					
4	A scientific law describes relationships among observable phenomena but does not explain them.					
5	A scientific law will never change because it has been proven true.					
6	A theory is a set of interrelated facts,, order in logical sequence.					
7	An accepted scientific theory is a hypothesis that has been confirmed by considerable evidence and has endured all attempts to disprove it.					
8	Any theory or concept of science can be challenged.					
9	Being close minded is unscientific.					
10	Being scientific one must have faith only in justified empirical evidence.					
11	Concepts provide uniform understanding about object to all.					

12	Good character building is not possible through science teaching.					
13	Honesty has nothing to do with science.					
14	Hypothesis provides and intelligible hunch to proceed for the investigation					
15	Imagination and creativity are not needed for scientific investigations.					
16	It is essential to have direct experience to arrive at a generalization					
17	It's not necessary to be scientific to conduct experiments in science.					
18	Only science allows self correction and critical introspection.					
19	Any knowledge in science is tentative.					
20	Result of one experiment suffices to the generalization about the related variables.					
21	Science believes in unproven facts of universe.					
22	Science has multiple ways of conducting research called "the scientific method."					
23	Science has nothing to do with curiosity about objects and events in the universe.					
24	Science is a body of knowledge, developed over years, about the universe.					
25	Science is a search for the ultimate truth.					
26	Science is a self defending human Endeavour.					
27	Science is a way of viewing the universe and how it works.					
28	Science is always based on beliefs, assumptions, and not on the observable.					
29	Science is just about the facts, not human interpretations of them.					
30	Science is to answer the questions about the objects and events in the universe only.					
31	Science means questioning, explaining, and testing.					

32	Science means studying the concepts developed and known by scientists.					
33	Science must include tests in nature that illustrate the validity of personal explanations offered.					
34	Science never promotes hatred and fundamentalistic chauvinism like religion & cast.					
35	Science proves facts true in a way that is definitive and final in given conditions.					
36	Science relies on deduction (x entails y) more than induction (x implies y).					
37	Scientific facts are tentative in nature and open to various interpretations.					
38	Scientific investigations are always free from personal biases.					
39	Scientific laws are absolute and unchangeable.					
40	Scientific laws have no universal application.					
41	Scientific processes are more important than the products of science.					
42	Scientific theories are just ideas about how something works.					
43	Scientific theories only change when new information becomes available.					
44	Scientists accept the existence of theoretical entities that have never been directly observed.					
45	Spiritual person can not be scientific.					
46	The concept about different objects and phenomena are different for different people according to their age and experience.					
47	The habit of questioning every scientific phenomenon is always desirable.					
48	Theories in science must be precise, clear and grounded on empirical data					
49	To cure chickenpox one must visit temple of goddess "shitala."					
50	Universal brotherhood is effectively promoted through science					

Qualities of science teacher

This scale is prepared for the self assessment of the science teachers to determine the extent of qualities possessed by the teacher which are expected to be in science teacher. This will Provide insight for the qualities yet to be developed. Qualities are distributed in two types common for all teachers and special for science teachers. There are fifty attributes having ten point rating scale. You are expected to rate your self on each of the attributes. Encircle the number which you think is the best suitable to express the extent to which you possess the given attribute on a ten point scale.

Example : Scientific Attitude 1 2 3 4 5 6 7 8 9 10

Name of the student: **Time:**

Roll No. **Date:**

A. Common attributes

		Low									High
1	Affection and affiliation toward student	1	2	3	4	5	6	7	8	9	10
2	Art of making complex concepts easy	1	2	3	4	5	6	7	8	9	10
3	Authentic knowledge	1	2	3	4	5	6	7	8	9	10
4	Commitment for the teaching profession	1	2	3	4	5	6	7	8	9	10
5	Communication skill	1	2	3	4	5	6	7	8	9	10
6	Computer literacy	1	2	3	4	5	6	7	8	9	10
7	Conduct extra classes for weak students	1	2	3	4	5	6	7	8	9	10
8	Confidence	1	2	3	4	5	6	7	8	9	10
9	Content mastery	1	2	3	4	5	6	7	8	9	10
10	Easily approachable	1	2	3	4	5	6	7	8	9	10
11	Enthusiastic	1	2	3	4	5	6	7	8	9	10
12	Explanation ability	1	2	3	4	5	6	7	8	9	10
13	Give guidance	1	2	3	4	5	6	7	8	9	10
14	Giving example related to daily life	1	2	3	4	5	6	7	8	9	10
15	Hard working	1	2	3	4	5	6	7	8	9	10
16	Innovative	1	2	3	4	5	6	7	8	9	10
17	Interactive	1	2	3	4	5	6	7	8	9	10

18	Motivator	**1 2 3 4 5 6 7 8 9 10**
19	Organised and systematic	**1 2 3 4 5 6 7 8 9 10**
20	Patience	**1 2 3 4 5 6 7 8 9 10**
21	Positive attitude towards students	**1 2 3 4 5 6 7 8 9 10**
22	Preciseness	**1 2 3 4 5 6 7 8 9 10**
23	Presence of mind	**1 2 3 4 5 6 7 8 9 10**
24	Punctuality	**1 2 3 4 5 6 7 8 9 10**
25	Putting theoretical knowledge in practical	**1 2 3 4 5 6 7 8 9 10**
26	Scientific attitude	**1 2 3 4 5 6 7 8 9 10**
27	Time management	**1 2 3 4 5 6 7 8 9 10**
28	Updated with current trends in education	**1 2 3 4 5 6 7 8 9 10**
29	Working together	**1 2 3 4 5 6 7 8 9 10**
30	Zeal	**1 2 3 4 5 6 7 8 9 10**

B. Specific attributes for science teachers			
		Low	**Average**	**High**
1	Ability to organize activities like field trip, brain storming, debate, science quiz, science exhibition etc	**1 2 3 4 5 6 7 8 9 10**
2	Concretizing abstract thinking	**1 2 3 4 5 6 7 8 9 10**
3	Acquainted with new technologies	**1 2 3 4 5 6 7 8 9 10**
4	Inculcating courage to question	**1 2 3 4 5 6 7 8 9 10**
5	Creativity	**1 2 3 4 5 6 7 8 9 10**
6	Enabling Critical thinking	**1 2 3 4 5 6 7 8 9 10**
7	Arousing and maintaining curiosity	**1 2 3 4 5 6 7 8 9 10**
8	Demonstrative ability	**1 2 3 4 5 6 7 8 9 10**
9	Drawing skills	**1 2 3 4 5 6 7 8 9 10**
10	Experimental skill	**1 2 3 4 5 6 7 8 9 10**

Annexure 5

11	Explorative	**1 2 3 4 5 6 7 8 9 10**
12	Keen observation power	**1 2 3 4 5 6 7 8 9 10**
13	Logical thinking	**1 2 3 4 5 6 7 8 9 10**
14	Open-mindedness	**1 2 3 4 5 6 7 8 9 10**
15	Realistic decision making ability	**1 2 3 4 5 6 7 8 9 10**
16	Reasoning ability	**1 2 3 4 5 6 7 8 9 10**
17	Team building	**1 2 3 4 5 6 7 8 9 10**
18	Objective analysis of task	**1 2 3 4 5 6 7 8 9 10**
19	Self critical (introspective)	**1 2 3 4 5 6 7 8 9 10**
20	Choosing rational judgement	**1 2 3 4 5 6 7 8 9 10**

Annexure 6

Activity Evaluation Sheet

Activity No :

Provide your responses for the activity _____ (write name of the activity)in order to provide feedback and suggestions to modify the given activity.

Name of the student: **Roll No.:**

Name of the activity: **Date:**

1. Is this a worthy task?

2. Which specific objective of science teaching achieved during this activity?

3. Identify the concepts and/or skills which are involved while performing/carrying out this activity:

4. Is the activity appropriate for would be science teachers to enable them in pedagogy? Justify your view points.

5. Did the activity appeal you? Yes / No. Rationalize your stand.

6. Has the activity scope for further modification? Yes / No. If yes, suggest the changes.

7. In your opinion to what extent would the activity :

Sr. No		VG 5	G 4	A 3	P 2	VP 1
1	Engage students' intellect.					
2	Actively involves students.					
3	Stimulates students' understanding and skills.					
4	Develop students understanding and skills.					
5	Stimulate students to connect with other disciplines.					
6	Stimulate students to connect with real world.					
7	Call for problem formation, solving and reasoning.					
8	Promote communication /interaction among students.					
9	Promote curiosity and interest in students.					
10	Suitable to apply in the daily classroom situation.					
11	Practically possible to use for science teaching.					
12	Provide them field exposure.					
	Overall Rating of the activity					

VG: Very Good **G**: Good **A**: Average **P**: Poor **VP**: Very Poor

Annexure 7

FEEDBACK SHEET

Name of the student: **Roll No.**

Give free and frank opinion for the improvement in the instructional processes of **'Teaching of Science'** on the following dimensions / activities:

1. **Demonstration:**
   Opinion:

   Suggestion:

2. **Field trips to Dharampur/ Community Science Centre, Vadodara and Nature Park of Sindharot:**
   Opinion:

   Suggestion:

3. **Group work:**
   3.1. Framing of **'Objectives of Teaching of Science'**
   Opinion:

   Suggestion:

3.2 Group discussion on **'Science Laboratory'**
Opinion:

Suggestion:

3.3 Library assignments on ***'Science and Society', 'Correlation of Science with other subjects'.***

Opinion

Suggestion

3.4 Activity on **'Teaching Aids'**
Opinion

Suggestion

Suggest activity/activities for the following units in 'Teaching of Science'

- **Nature of science**

- **Objectives of science**

- **Approaches of teaching science**

- **Methods of teaching science**

- **Models of teaching science**

- **Resources of teaching science**
  - Laboratory
  - Teaching aid
  - Technology
  - Science Curriculum

- **Science activities**
  - Project work
  - Science quiz
  - Science fair
  - Aquarium
  - Bird watching
  - Star gazing
  - Science club
  - Evaluation in Science

Annexure 8

Programme Evaluation Sheet

Provide your responses for the listed activity in order to improve the instructional process of the course **C 507: Teaching of Science**
Rate each of the activity on five point rating scale; encircle the number which represents its status.

Name of the Student: Roll No :

e.g.: Approaches to science Teaching:

5	4	3	2	1
Very Good	Good	Average	Needs Improvement	Poor

Sr. No	Name of the Activity	Rank	Actual learning outcome/s taken place in your self i.e. Gain information, specific behaviour change, increase in knowledge, awareness, change in attitude, sensitization etc
1	**Quality Expected from Science teacher** 5 4 3 2 1		
2	**Demonstration of science concepts** 5 4 3 2 1		
3	**Objective of science teaching and historical development of science** 5 4 3 2 1		
4	**Field trip to Dharampur Science Centre** 5 4 3 2 1		
5	**Science laboratory** 5 4 3 2 1		

6	**Value inculcation** 5 | 4 | 3 | 2 | 1		
7	**Visit to community Science Centre Vadodara** 5 | 4 | 3 | 2 | 1		
8	**Film show on global warming** 5 | 4 | 3 | 2 | 1		
9	**Best out of waste (Neelaben Dongre)** 5 | 4 | 3 | 2 | 1		
10	**Viewing Video recording and discussion** 5 | 4 | 3 | 2 | 1		
11	**Science Process Skills & their evaluation** 5 | 4 | 3 | 2 | 1		
12	**TLM in science (Listing the activities chapter wise in group)** 5 | 4 | 3 | 2 | 1		

13	**Brainstorming on scientific Method (Dr. R C Patel)** 5 | 4 | 3 | 2 | 1		
14	**Methods of teaching and instructional materials provided** 5 | 4 | 3 | 2 | 1		
15	**Inquiry training model** 5 | 4 | 3 | 2 | 1		
16	**Role play on status of science club in schools** 5 | 4 | 3 | 2 | 1		
17	**Evaluation techniques and tools for science learning** 5 | 4 | 3 | 2 | 1		
18	**Demonstration II** 5 | 4 | 3 | 2 | 1		
19	**Formation of online Group and its execution** 5 | 4 | 3 | 2 | 1		
20	**Developing Improvised Kit for Secondary science teachers** 5 | 4 | 3 | 2 | 1		

Annexure 9

Information Sheet

1) Name:

2) Roll no:

3) Contact No :

4) Email address : (preferably in yahoo)

5) Date of Birth:

6) Sex :

7) Mother tongue :

8) Educational qualification :

- B.Sc.: _____ _____ _____
  (Subjects)

- M. Sc.: _____ _____ _____
  (Subjects)

9) Teaching experience in number of years (if any):

Annexure 10

List of Experts

A. List of experts to whom the tools were sent for their valuable suggestions

Prof. Anil Ambasana Associate Professor Department of Education Rajkot University, Rajkot	**Prof. Bharat Joshi** Associate Professor Department of Education Gujarat University, Ahmadabad
Prof. H O Joshi Head, Department of Education, Saurashtra University, Rajkot	**Prof. Mahesh yagnik** Former vice chancellor & Department of Education Sardar Patel University, Vallabh Vidhya Nagar
Prof. D R Goel Professor in Education Department of Education The M S University of Baroda, Vadodara.	**Prof. H. J. Patadia** Professor in Education Department of Education The M S University of Baroda, Vadodara
Prof. R G Kothari Former vice chancellor, VNSGU, Surat & Professor in Education, The M S University of Baroda, Vadodara	**Prof. S Kumar** Former Dean Professor in Education, The M S University of Baroda, Vadodara
Prof. S P Malhotra Former Vice Chancellor Professor in Education, Kurukshetra University, Kurukshetra	**Dr. A Ramachari** Assistant Director QETP Oxford Educational Institution Oxford public School Kadivali west Mumbai
Prof. S G Shah Former Head, Department of Education VNSGU, Surat	**Dr. Ashish kumar Gurg** Associate Professor, North Eastern Regional Institute of Education, Shilong
Dr. Ashutosh Biswal Associate Professor Department of Education The M.S. University of Baroda Vadodara	**Dr. C Bhogayata** Rtrd. Professor in Education Department of Education Bhavnagar university Bhavnagar

Dr. Pallavi Patel Professor in Education Department of Education Sardar Patel Unvieristy Vallabh Vidhyanagar	**Dr. Shashi Vanzari** Head Department of Education Associate Professor in Education Nagpur
Prof. Vasant Bhatt Professor in Education Regional Institute of Education, Mysore.	**Shree Sanajay A. Shah** Practicing Science and Mathematics teacher since 21 year
Prof. S C Panigrahi Head Department of Education Professor in Education, The M S University of Baroda, Vadodara.	**Prof. R. Mooliya** Rtrd. Professor Gujarat university Ahmadabad

B. List of Experts to whom the initial draft of the Developed Activity Based Science Teaching Programme was sent for valuable suggestions

Dr. Ramesh Babu Professor in Education Regional Institute of Education, Bhopal.	**Prof. R. Mooliya** Rtrd. Professor Gujarat university Ahmadabad
Dr. B R Sitaram Director Zeal Education Society The Galaxi Education Rajkot	**Prof. Mahesh yagnik** Former vice chancellor & Department of Education Sardar Patel University, Vallabh Vidhya Nagar.
Prof. Anil Ambasana Associate Professor Department of Education Rajkot University, Rajkot	**Dr. Shashi Prabha** Department of Science and Mathematics Educaton, NCERT New Delhi
Prof. S P Malhotra Former Vice Chancellor Professor in Education, Kurukshetra University, Kurukshetra	**Dr. A Ramachari** Assistant Director QETP Oxford Educational Institution Oxford public School Kadivali west Mumbai

Dr. R N Ray Professor in Education Regional Institute of Education, Bhoovneshwer.	**Prof. Vasant Bhatt** Professor in Education Regional Institute of Education, Mysore.
Shree Mukesh Pathak Coordinator, Children Science Congress, Gujarat Nature Conservation Society Gujarat.	**Dr. C Bhogayata** Rtrd. Professor in Education Department of Education Bhavnagar university Bhavnagar

C. List of Experts who were involved during the implementation of the ABSTP

Name of the activity	**Name of the expert**
Preparing best toys from waste material	Ms. Neela Dongre Active Member, Science club & Children Science Congress CSC Vadodara
Science Demonstrations	Dr. R C Patel Dr. Preeti Chaudhary
Value Inculcation through ST.	Dr. Kashyapi Awasthi
Visit to community science centre Film show on global warming	Mr.Jitendra Gavli Director ,CSC, Vadodara
Visit to DSC,Dharampur	Mr. N T Kasar Director , DSC, Dharampur

Annexure 11

Yahoo group notification

Yahoo! Groups: Congratulations! You created science_2009_10.
Mon, 20 July, 2009 8:37:05 AM

From: Yahoo! Groups
<notify@yahoogroups.com>
Add to Contacts

To: jyotirajaji@yahoo.co.in

Your science_2009_10 group at Yahoo! Groups is good to go.

Here are the details on science_2009_10:
Group home page: http://groups.yahoo.com/group/science_2009_10
Group email address: science_2009_10@yahoogroups.com

Ready to start?
Get the ball rolling by posting the very first group message. Then add photos, create an event, or whatever. In short, make yourself at home in your new group.

Simply drop by the science_2009_10 homepage now. To keep the online conversation moving, be sure to invite friends, family, and others who share your passion.

You can also check out Moderator Central to get the latest news, information, and services for moderators:
http://us.rd.yahoo.com/evt=42511/*http://moderators.groups.yahoo.com/

Thanks,
Yahoo! Groups

Your use of Yahoo! Groups is subject to http://docs.yahoo.com/info/terms/

Annexure 12

Syllabus of C 507 : Teaching of Science at B.Ed. Level

Objectives:

1. To develop among the teacher trainees an understanding of science as a discipline.
2. To enable the teacher trainees to understand the importance of teaching science in school.
3. To make the teacher trainees aware of the alternatives in organizing the system of science instruction.
4. To develop in them the necessary understanding and skills to organize, evaluate and improve the system of science education.

Course Outline:

Unit I : Nature of Science

1. Science as product as well as process
2. Science in everyday life.
3. Relationship of science with other subjects.
4. Value development : intellectual, utilitarian, aesthetic, disciplinary, training in scientific attitude, vocational.

Unit II : Objectives of teaching Science

1. General and specific objectives
2. Taxonomy of objectives : Cognitive, Affective &Psycho-motor
3. Mastery and Developmental levels of objectives.

Unit III : Content-cum-Methodology

1. Methods according to the nature of content
2. Approaches for teaching science
3. Planning for different methods of teaching
   * Lecture
   * Lecture-cum-demonstration
   * Historical
   * Heuristic
   * Project
   * Assignment
   * Discussion
   * Innovative Methods
4. Approaches
   * Integrated
   * Ecological
   * Inductive
   * Deductive
   * Problem Solving
   * Systems
5. Planning
   * Annual
   * Unit
   * Lesson

Unit IV : Models of Teaching Science

1. Concept Attainment Model

2. Inquiry Training Model

Unit V : Resources for Teaching Science

1. Laboratory
2. Teaching Aids
   * Low Cost * No Cost * Improvised
3. Technology

Unit VI : Science Curriculum

1. Recommendations of various commissions and committees
2. Recent trends in curriculum development
3. Role of teacher in curriculum development & transaction
4. Qualities of a good science textbook, teachers handbook, journals, magazines.

Unit VII : Science Activities

1. Importance of science activities
2. Planning & Organization of field work, project work, science quiz, excursion, science exhibition, science fair, aquarium, bird watching, star gaze.
3. Science club.

Unit VIII: Evaluation in Science

1. Criteria of a good test
2. Formative & Summative Evaluation
3. Merits & Demerits of different types of evaluation items
4. Evaluation of Practical Work & Viva-Voce.

Activities :

1. Analysis of Science Textbook.
2. Survey of Science Laboratory in a school.
3. Preparation of lesson/unit plan by following different methods of teaching.
4. Preparation of materials & programmes to inculcate scientific attitude.
5. Script writing for Radio/TV/Video on science topics.
6. Preparing programmes for computer based learning.
7. Evolving suitable technique(s) to evaluate laboratory work.

References :

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2. Richardson, J.S. : Science Teaching in Secondary Schools.
3. Das, R.C. : Science Teaching in Schools.
4. Schmidt & Rockcastle : Teaching Science with Everyday Things.
5. Chauhan, S.S. : Innovations in Teaching Learning Process.
6. Karla, R.M. : Innovations in Science Teaching.
7. Sanadhya, R.P. : Personality characteristics and scientific attitude.
8. Yadav, M.S. : Teaching of Chemistry.
9. Young, B.L. : Teaching Primary Science.
10. Carin, A. & Sund, R.B. : Discovery Teaching in Science.
11. Vaidhya, N.N. : Science Teaching for Twenty-first Century.

Annexure 13

Outline of the Activity Based Science Teaching Programme for student teachers and schedule of implementation

Sr. No.	Name of the Activity	Date	Time (Minutes)	Objectives of the activity	Method/Methods Learning Experiences	Expected Outcome of the activity
1	Introductory session	29.06.2009 30.06.2009	45 minutes 45 minutes	▶ To make the student teachers interact with the peer group in pair and then introduction Student teachers by each other. ▶ To help the student teachers to know each other. ▶ To increase the interaction of the student teachers. ▶ To make Student teachers understand about the peer member ▶ To help student teachers acquire the ability to know others through interaction and eliciting the information from the peer members. ▶ To provide the student teachers opportunity to present the relevant information about his/her partner in front of the group.	▶ Orientation to students, pair – share, discussion and introducing the partner to the group.	▶ Awareness about the programme and Development of fellow feeling in the group members.
2	Demonstration of activities based on selected concepts from Science textbook	03.07.2009 21.07.2009	35 minutes (60 min × 4) = 240 minutes	▶ To help Student teachers select, decide, invent content related demonstration which is feasible to perform in classroom situation. ▶ To procure /prepare/develop the required/method/equipment and materials. ▶ To encourage student teachers to perform in front of the peer group and teachers. ▶ To provide exposure to observe various demonstrations performed by their peers. ▶ To enhance their demonstration ability ▶ To assist Student teachers sharpen their observation ability, critical thinking, creative thinking, analytical and synthetic ability. ▶ To create an environment where in discussion is encouraged to clarify their content/demonstration related	▶ Assignment of task, Organizing the activity on a select date, Demonstration performance by student teachers in front of group on select concept from school science secondary level followed by discussion and question answer on the performed	▶ Improvement in experimental skills and clarity of concepts ▶ Increased confidence level for demonstration in front of students.

				doubts	demonstration. ▶ Focused group discussion and feedback for improvement.	
3	Enlisting Qualities of an efficient Science Teacher	16.07.2009 18.07.2009 20.07.2009	45minutes 45 minutes 45 minutes (Total 135 minutes)	▶ To enable student teachers to identify the essential qualities every science teachers should have ▶ To enlist the essential qualities to be possess by every science teacher. ▶ To make the student teachers aware about expectations of society from science teachers by sharing the listed qualities. ▶ To develop a science teacher quality scale by refining the listed qualities. ▶ To make the student teachers rate oneself on the essential qualities Science Teachers Qualities Scale) STQS. ▶ To help student teachers identify one's strength and weaknesses as a teacher on the basis of own rating.	▶Small group discussion on qualities of good science teachers, Preparation of comprehensive list of qualities of science teacher. ▶Referring it to the expert and finalizing the checklist. ▶Test of science teachers qualities	▶Awareness, motivation and sensitization for qualities to be acquire during the training programme. ▶Increase in Self evaluation ability ▶Role clarity is achieved
4	Formation of Online group	06.07.2009 20.07.2009 Onwards	No time bound activity	▶ To prepare student teachers to create their own email account. ▶ To prepare Student teachers to use the internet service to share information with peer group. ▶ To enable Student teachers to collect the required information from internet to teach science. ▶ To disseminate the science related information to the group for improvement of teaching. ▶ To create a network of science teachers to share their expertise and learn from others. ▶ To enable Student teachers to use the online group for submission and dissemination of science knowledge.	▶Orientation and ▶Practical class ▶Discussion on collected information ▶Submission of assignments online ▶Sharing of information about educational websites, latest news about science.	▶Increase in their info-savvy,techno-savvy skills. ▶Networking of all the student teachers for disseminating the knowledge and promoting science. promoting paperless culture

5	Critical analysis of objectives of teaching of science as decided by various institutions / commissions / committees	22.07.2009 28.07.2009	(35+60) 95 minutes	► To make student teachers aware about the importance of teaching science at secondary level. ► To make the student teachers aware about the various skills, ability and qualities to be developed by student teachers ► To give student teachers historical perspective of change in emphasis on different aspects of objectives of teaching science ► To study the objectives of teaching science as suggested by various commission and committees at different point of time in India ► To enable the student teachers decide the objectives of teaching science at secondary level in the contemporary society. ► To enable student teachers to judge the relevance/ comprehensiveness of objectives of teaching science at contemporary society.	►Focused group discussion, ►Group activity. ►Discussion followed by individual writings	►Increase in the understanding about objectives of science teaching and progressively learning experiences to be provided in the class rooms ►Task clarity is achieved
6	Brainstorming session on Scientific Method	28.09.2009	(45×2) 90 minutes	► To make Student teachers aware about the scientific method of inquiry. ► To provide Student teachers opportunity to brain storm about various topics which can be addressed through brainstorming	►Puzzling situation and brainstorming on a given situation, discussion on process of inquiry	►Awareness about the usage of brainstorming and sensitization for using it in classrooms
7	Orientation about various methods of teaching of science	24.07.2009	60 minutes	► To make Student teachers aware about the various methods of teaching science and provide criteria of selecting a suitable method for particular content.	►Orientation to various methods of teaching through power point presentation	►Awareness, clarity about various methods of teaching
8	Preparing Lesson Plan by following suitable	30.11.2009 04.12.2009	45minutes 35 minutes	► To enable Student teachers to select the suitable method for their content ► To understand the criteria for selecting any method of teaching.	►Providing an instructional material ►Discussion about	►Implementation of methods in classrooms and reflection

	method(s) of Teaching Science and Implementing the same in the real classroom situation	21.12.2009	45 minutes	► To enable Student teachers to develop lesson plans using appropriate method. ► To practice the developed method in practicing schools on a given content. ► To critically evaluate the implementation and discuss the problems faced by student teachers in executions.	the methods of teaching context of executing it in practicing class. ►Group Discussion on methods with specific content in small group ► Developing lesson plans for teaching through various Focused group discussion ► Presentation of ideas ► Refinement of ideas ► Practicing in schools	on it
9	Exploring possibilities of inculcating values through teaching of science	17.08.2009 27.11.2009 28.11.2009 04.12.2009 21.12.2009	45 minutes 60 minutes 35 minutes 45 minutes	► To make the student teachers aware about the specified value which can be inculcated while teaching science at secondary level ► To enable student teachers to explore the possibilities of integrating the different values in the given content at secondary science. ► To decide the appropriate learning experiences to inculcate the specified value. ► To make Student teachers realize that these values can be integrated while teaching science at secondary level. ► To decide the plugging points in the content where in specified values can be integrated. ► To actually practice the integrated values during the practice teaching sessions in the practicing schools. ► To help the student teachers critically judge the extent and effectiveness of values practiced in schools.	► Focused group discussion ► Presentation of ideas ► Refinement of ideas ► Practicing in schools ► Reporting in written form ► Discussion on its implementation	►Interest and attitude for teaching science is increased

10	Science Excursion to Dharampur Science Centre	01.12.2009 02.12.2009 04.12.2009	One day (six hours in the field)	► To provide Student teachers experience of the science excursion ► To involve Student teachers in planning, Organizing and executing the science excursion ► To enhance student teachers understanding about the concept of science knowledge. ► To expose Student teachers to interact with the exhibits and plots present in field and enhancing their understanding about application of learnt concepts. ► To provide Student teachers experiential learning through science excursion.	►Planning, Organizing and execution of a visit to the center. Clarifying doubt of the students in the field. ►Motivating them for observation	►Clarity regarding the science concept increased
11	Awareness, sharing and integrating (wherever possible) technology in teaching of science	23.12.2009	45 minutes	► To orient the student teachers for various electronic media and print media through which science can be taught ► To discuss about scope of using Student teachers in secondary science classes. ► To list out educational journals, websites to teach science at secondary level.	►Discussion followed by library and reference work ►Preparing list of websites, movies, and aids.	►Increased computer-literacy and using it for information gathering & disseminating ►Online submission of assignment
12	Awareness regarding Science Process Skills	07.10.2009 20.01.2010	(45 + 60) 105 minutes	► To make the student teachers aware about the science process skills; both basic and integrated process skills. ► To enable student teachers to identify different process skills used by Student teachers in various science activities. ► To discuss various ways to develop science process skills among secondary school students. ► To provide exposure about the evaluation of science process skills.	►Orientation about science process skills identifying basic and integrated science process skills by Situation based questions. ►Discussion on how to evaluate these skills	►Increased understanding about processes of science
13	Planning for	11.11.2009	(45×3)	► To make student teachers aware about the importance of	►Written guideline	►Clarity about

	an ideal multipurpose science laboratory	25.01.2010 25.01.2010	135 minutes	science laboratory for secondary science classes ► To provide exposure by visit to science laboratories of secondary schools. ► To enable student teachers to discuss and prepare a plan for multipurpose science laboratory. ► To present a plan for secondary science laboratory before the group. ► To prepare Student teachers to evaluate the laboratory plans presented by the peer groups. ► To enable Student teachers to learn the criteria of an ideal science laboratory.	for observing the laboratory. ►Visit to science laboratory. ►Small Group work for designing their own prepare their science laboratory ►Presentation by group with Power point presentation, charts , displays ►peer evaluation ►	planning for new science laboratory ►Designing , developing plan of science laboratory
14	Discussion on how to make science learning joyful	21.01.2010	60 minutes	► To make the student teachers aware about various mode to make science learning joyful. ► To identify various activities to make science joyful. ► To orient Student teachers for play way and experiential learning to make science interesting.	►Discussion on scope of non formal way to teach science. ►Science club, waste materials, movie, games, science museums etc	►Innovative ideas are generated for making science interesting
15	Visit to Community Science Centre Vadodara	23.01.2010 18.02.2010	120 minutes 240 minutes	► To provide Student teachers exposure to the community science centre. ► To provide student teachers exposure to the resources of science learning. ► To provide Student teachers understanding of various science concepts and teaching learning materials. ► To enable Student teachers to realize the importance of community science centre as a tool to popularize science among school students & member of the community at large. ► To create a network of learned community to popularize	►Planning organizing and coordinating with students and authority CSC Vadodara. Taking them to the CSC Vadodara; providing them	►Interest for science teaching is increased, awareness about CSC is generated

				science among society.	first hand experiences of science display.	
16	Viewing prerecorded video of demonstrations of activities / experiments based on concepts from science curriculum and discussion on it	10.02.2010	Four hours	► To provide student teachers exposure for effective demonstration. ► To identify the errors/mistakes committed by student teachers ► To find out alternative solutions, activities to make the concepts more clear. ► To enable Student teachers to generate newer ideas for activities in science classes.	► Video recordings of previous year students , few recordings of workshop on science were shown to them	► Clarity about their mistakes resulted in better performance in Demonstration performance
17	Film show on global warming	19.02.2010	60 minutes	► To provide Student teachers exposure to the issues related to environment ► To make Student teachers realize the impact of film as a powerful media to teach science related issues	► Film show on inconvenient truth Followed by discussion ► Listing causes of global warming and role of teacher in reducing it	► Awareness, sensitization about environmental problems and global warming
18	Demonstration of activities based on selected concepts from Science textbook	16.02.2010	35 minutes + (60×4) 240 minutes (Total 275 minutes)	► To check student teachers' experimental skills. ► To provide Student teachers exposure to demonstration based on various science concepts. ► To study the level of enhancement in selecting the activity and performing the demonstrations.	► Assigning the task date finalization ► Individual student's presentation on select concept followed by discussion on the performed demonstration ► Feed back for	► Realization of increased confidence in performing the demonstration

					further improvement. ► Assigning marks to the students	
19	Preparation of TLM from waste materials (Best out of Waste)	17.02.2010	90 minute	► To provide exposure for preparing science TLM from west materials ► To enable Student teachers to prepare various science material from the waste materials	► Collection of west material from home. Learning to prepare the toys to explain the science concepts	► Sensitization about using waste materials to make science classed live, interesting and joyful
20	Identifying and enlisting possible activities / TLMs from textbook of Science	01.02.2010 03.02.2010	45 minutes 45 minutes	► To enable Student teachers to list out equipments, materials, which can be used in science teaching and learning at secondary level ► To make Student teachers aware about the teaching learning needed for science classes ► To prepare chapter wise listing of equipments to tech science ► To prepare a comprehensive listing of the equipments in science. ► Preparing a comprehensive improvised kit for science classes	► Group work ► Formation of the group ► Listing chapter wise equipments ► Models preparing in group ► Charts	► A comprehensive list of TLM and activity for VII and IX grade is prepared

21	Conceptualization Science Club through Role playing	22.02.2010	Five to six hours for field work 40 minutes for performance	▶ To enable Student teachers to learn about science club for teaching science. ▶ To make Student teachers aware about the status of science club in schools. ▶ To disseminate the knowledge to the peer group	▶ Reference work, visit to the science club of CSC and Zenith School ▶ Dramatization to provide information to the group	▶ Sensitization about status of SC in schools and role of teacher in same. An oath and commitment for improving quality of science teaching in school is taken
22	Developing innovative items /techniques for evaluation of students in Science	11.01.2010 18.01.2010	45 minutes 60 minutes	▶ Student teachers will be able to ▶ Identify various type of evaluation techniques for measuring learning of students ▶ Students will be able to expose for some innovative methods of evaluation of science learning ▶ Develop innovative tool to measure learning of science.	▶ Discussion based on their past experiences ▶ Showing them some tools of evaluation of psychomotor skills ▶ Showing innovative tool to evaluate their understanding of science concepts ▶ Group work on preparing tools	▶ Development of various science puzzles, stories and games to evaluate science learning.

23	Understanding the importance of Inquiry Training Model in teaching of science	12.03.2010	60 minutes	► To provide student teachers the experience of process of inquiry and enable to understand the importance of inquiry in science. ► To prepare Student teachers for using ITM in secondary science classes. ► To enable Student teachers to prepare lesson plans using these model.	►Putting student teacher a puzzling situation and carry out the process to get the process of inquiry ►Discussion on practicing this model in class room	►Clarity and awareness for using this model in classroom

Annexure 14

Instructional Material on Science Concepts

1. **Archimedes Principle** States that any object immersed in a fluid is buoyed up by a force equal to the weight of the displaced fluid. It can also be states as the apparent loss in the weight of a body when it is immersed in a fluid is equal to the weight of the fluid displaced by it.

2. **Avogadro's hypothesis** States that all gases occupying equal volumes at the same temperature and pressure contains equal number of molecules

3. **Bernoulli's theorem** gives the relationship between the pressure and the velocity at any point along a streamline of a fluid in steady motion. The theorem states that the sum of the pressure and the kinetic energy per unit volume remains constant at constant level along any such streamline.

4. **Bolthsman constant** is the value of the universal gas constant per molecule that is R/No where R is the universal gas constant and No. is the Avogadro's number. Its value is $1.38*10^{-23}$ J/k

5. **Boyle's Law** states that the product of the pressure and volume of an enclosed gas at constant temperature remains constant

6. **(a) Centripetal force** Is force which acts on body in circular motion, it is directed towards the center of the circle.
   (b) Centrifugal force is the force which acts on a body in circular motion; it is directed away from the center of the circle

7. **Conservation of angular momentum principle** states that if there is no external torque acting on a system, its total angular momentum remains constant

8. **Conservation of energy Principle** states that energy may be transformed from one type to another without loss, and in a closed or isolated system the total amount of energy remains constant

9. **Conservation of linear momentum principle** states that if no external force acts on a system the total linear momentum of the system remains constant.

10. **Coulomb's law of force for electric charges** states that the force of attraction or repulsion between the two small electric charges is proportional to the product of the charges, and inversely proportional to the square of the distance between them.

11. **Coulomb's law of force for magnetic poles** states that the force between two magnetic poles is proportional to the product of the strength of the poles and inversely proportional to the square of the distance between them.

12. **Doppler's effect** is an apparent change in the frequency of a wave due to relative motion of source and the observer.

13. **Electromagnetic induction** is a phenomenon discussed by Faraday and Henry in1831. Whenever the magnetic field around a wire changes, an electromotive force is induced

in the wire ii) the strength of the induced field is proportional to rate of change of the magnetic flux passing through the circuit.

14. **Equation of mass and energy principle** states that a mass m is equivalent to an amount of energy E, and the equation relating the two is $E = mc^2$ where c is the speed of light

15. **Fahrenheit temperature scale** is one in which the ice point is assigned the value of 32^0 and the steam point is assigned the value of 212^0.

16. **Faraday's law of electrolysis:** i) in an electrolytic cell the mass of ions liberated from the solution is proportionate to the quantity of charge passing through the cell
ii) The amount of an ion deposited on an electrode is proportionate to the chemical equivalent of the element

17. **Faraday's law of electromagnetic induction** is the negative time rate of change of magnetic flux linked with a circuit is equal to the induced elf in the circuit.

18. **General gas law** is sometimes called the law of ideal gases. The product of the pressure and volume of an ideal gas is proportional to its absolute temperature PV = nRT.

19. **Hook's law** states that the ratio of the stress in an elastic body to the strain produced is a constant.

20. **Huygen's principle** states that each point in a wave front can be considered on a source of wave, the subsequent position of the wave front after the lapse of a small time interval can be found by drawing the envelope to all of the small waves which were sort out by all the individual point on the first wave front as the beginning of this time interval

21. **Newton's law of universal gravitation** states that any two bodies in the universe attract each other with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them

22. **Newton's laws of motion:**
*i) **First law:** (Inertia)* A body at rest will remain at rest and a body in motion will continue in motion with undiminished speed in a straight line, as long as no unbalanced force acts on it.
*ii) **Second law:*** if an unbalanced force acts upon a body, the body will be accelerated. The magnitude of the acceleration is proportional to the magnitude of the unbalanced force and the direction of the acceleration is in the direction of the unbalanced force.
*iii) **Third law:*** whenever one body exerts a force upon another, the second body exerts a force equal in magnitude and opposite in direction on the first body. This is sometimes called the law of action and reaction.

23. **Ohm's law** states that the current (I) in a conductor is proportional to the difference of potential across that conductor. The factor of proportionality is called the (R) resistance of the conductor.

24. **Pascal's principle states** that whenever the pressure on a confined liquid is increased or diminished at any point, the change in pressure is transmitted equally throughout the entire liquid

25. **Reflection of a wave (laws)**
a) The incident ray, the normal and the reflected ray all lie in one plane
b) The angles of incidence and reflection are equal

26. **Simple harmonic motion** is a type of periodic motion exerted by a body that is acted upon by a force which is proportional to the displacement of the body from its equilibrium position and opposite in direction to the displacement

27. **Snell's law of refraction:** states that the ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant. This constant is called the refractive index of second medium with respect first medium.

28. **Stat volt** is the unit and potential difference in the C.G.S. system of units

29. **Thermodynamic laws**
I) ***First law:*** the quantity of heat added to a system is equal to the work done by the system plus the change in change in internal energy of the system

II) ***Second law***: heat on it's own accord will always flow from higher to lower temperature. An alternative statement is that it is impossible to construct an engine which, operating in a cycle, will produce no effect other than the extraction of heat from a reservoir and the performance of an equivalent amount of work.

30. **Universal constant of gravitation** is the constant of proportionality in Newton's law of universal gravitation. It is equal to the force with which two unit masses attract each other when placed a unit distance apart.

31. **Universal gas constant** is the factor of proportionality of the general gas law when refined to one mole of an ideal gas.

32. **Avogadro's law** states that equal volumes of all gases contain equal number of molecules under same condition of temperature and pressure.

33. **Avogadro's number** (Avogadro's constant) is the number of atoms or molecules in a mole of substance. It is 6.02252×10^{23} particles.

34. **Boyle's law** states that at constant temperature the volume of a gas is inversely proportional to the pressure. (or) Volume of a gas at constant pressure is directly proportional to it's absolute temperate , V = constant at constant t and n

35. **Charles's law** states that at constant pressure all gases expand by 1/273 of their volume at 0^0 for every 1^0 C , V T at constant t and n.

36. **Dalton's law of partial pressure** the total pressure of a mixture of two or more than two gases is equal to the sum of the pressure exerted by each gas in the mixture, if it were present alone and occupied the volume equal to that of the whole mixture

37. **Faraday's constant** (F) is the quantity of electricity equal to a mole of electrons. It is equal to the product of Avogadro's constant and the change on an electron = 964870 Coulombs per mole

38. **Gas laws** govern the behavior of ideal gases between their temperature, pressure and volume

39. **Graham's law of gaseous diffusion** the rate of diffusion of a gas is inversely proportional to the square root of their densities or molecular weight.

40 **Ideal gases** one those exactly obey gas laws.

41. **Pauli's exclusion principle** states that no two electrons in a neutral atom can have the same set of four quantum numbers

42. **Periodic law** states that the properties of the elements are the periodic functions of their atomic number

43. **Uncertainty principle** It is impossible to find, simultaneously with a great accuracy the position and the momentum of a particle

44. **Perfect gas or ideal gas** is a theoretical concept of gas which is expected to perfectly obey gas laws

45. **Vaderwaal's force** is the force of attraction which exists between atoms or molecules of all substances

46. **Allotropy is** when a chemical element exists in two or more different forms, these different forms are called allotropes. The phenomenon is allotropy.

47. **Combustion:** is a process of combining with oxygen accompanied by liberation of heat and light.

48. **Ignition temperature** is the temperature at which a particular substance catches fire.

49. **Isotopes are** the atoms of the same elements having same number of protons but different number of neutrons in the nucleus.

50. **Pressure** is the force per unit area acting perpendicular to the force.

51. **Buoyancy** is every liquid exerts an upward force on objects immersed in it. This upward force is call the buoyant force and this phenomenon is buoyancy.

52. **Refractive Index** is the ratio of velocity of light in vacuum to velocity of light in medium.

53. **Adaptation** is the shape, size, color, structure and habitat that enable the organism to live successfully in it's environment are called adaptations

54. **Dalton's atomic theory**
    i) All matter is made up of very tiny particles which are indivisible called atoms
    ii) An element is a substance that has only one kind of atoms.
    iii) Atoms of elements combine in many ways to create the variety of complexity seen around us.

55. **Dalton's law of constant proportion** states that in a particular substance the proportion by weight of its elementary constituents remains the same.

56. **Dalton's law of multiple proportions** states that same elements can combine in several ways to form different substances.

57. **Mendeleef's periodic law** says properties of elements are periodic functions of their atomic weight.

58. **Electronic configuration** is the arrangement of electrons around the nucleus.

59. **Valence electron** is the number of electrons in the outermost orbit.

60. **Valency** denotes number of electrons an atom loses or gains in making a bond with another atom

61. **Ionic bond** when two ions are bonded together by their electric charges it is ionic bond (or) a bond formed between two ions where one looses the electrons and the other gains the electrons.

62. **Covalent bond:** a bond formed between ions by mutual sharing of electrons.

63. **Work** = force x distance

64. **Energy** = capacity to do work

65. **Power** = rate of doing work

66. **Specific heat** is the amount of heat required to raise the temperature of one gram of substance by 1^0C.

67. **Electric power**: work done by electrical energy / time taken.

68. **Caloric value of fuel** is the heat produced by burning one gram of fuel.

69. **Biosphere** A complex of communities maintained under the climatic conditions of a region.

70. **Power** time rate of imparting energy by a source is called power.

71. **Cell theory** Each and every cell is made up of many cellular substances. A cell is a structural and functional unit of life

72. **Species** It is the fundamental unit of classification. It consists of a group of individuals with similar characters that reproduce by interbreeding.

73. **Darwin's theory of natural selection:**
    It consists of following main points:
    1) **Variation**: many differences or variations can be seen among organisms of one species
    2) **Prodigality of production**: Every organism tends to produce off springs in huge amounts than required.
    3) **Struggle for existence**: All the off springs do not survive due to high competition among animals for physical needs
    4) **Survival of the fittest**: There is always struggle among the organisms to survive. The organisms which is fit to live in the provided environment survives others perish

74. **Mendel's laws of genetics**
    *i) **Law of dominance:*** out of paired allelic genes controlling contrasting characters, one is dominant and prevents the expression of other recessive gene

*ii) **Law of segregation:*** pair of genes controlling one character are segregated from each other during gamete formation.
*iii) **Law of independent assortment**:* inheritance of one pair of contrasting characters is independent of the other pair of contrasting characters

75. **Biotic factor** living organisms of biosphere with their interrelationships.

76. **Abiotic factor** all environmental factors interacting with biotic factors.

77. **Pollution** an undesirable change in the environment.

78. **Ascent of sap theories**
1) Root pressure helps in ascent of sap
2) Transpiration from leaves creates necessary pressure for ascent of sap
3) Cohesive force theory: A continuous column of water is formed in the entire plant due to the cohesive and adhesive forces of water molecules. This column rises upwards due to suction force developed due to transpiration.

79. **Gene Theories:**
i) Genes are the structural units of organisms
ii) Beadel and Tautum theory: One enzyme is responsible for one gene. One gene one polypeptide theory: one polypeptide is responsible for one gene.

80. **Ecosystem** The interactions between living and nonliving components.

Annexure 15

Instructional on Methods of Teaching Science

Jyotsna A Amin

The effectiveness of teaching depends mainly upon the method that the teacher adopts. The knowledge of different methods of teaching science is essential in order to improve upon their teaching by practice and following those methods. The teacher is however free to choose any method that he thinks is suited to the students. Some of the commonly used methods are discussed here.

Lecture Method

Concept

Lecture is the most commonly used method of teaching any subject. This method is most popular for the colleges and schools with large classrooms where member of students are more. In this method teacher is the active speaker and students are passive listeners. Since the students do not actively participate in this method of teaching, it is a teacher centered and information centered method where teacher is the sole resource of classroom instructions. Eighty percent of the scientific information or principles that students receive from their teachers come through the lecture method. It involves verbal presentations of ideas, concepts, generalizations, and facts. The objective is the stuff the students with the information. The teacher does much of the activity in the form of talking while the pupils are either passive or slightly involved. Students are provided notes in the written or oral forms. The teacher goes ahead with the subject matter at his own speed. Teacher may use black board, dictate notes and give examples to simplify the content to the students.

Essentials:

Two teaching skills which make the lecture effective are

1. Clear and good command over language and
2. Ability to develop the blackboard work neat and clearly.

Apart from this clarity of thoughts and mastery on the content is expected to continue lecturing fluently and reaching to the students level.

Merits/ Advantages:

- Economic in terms of time and effort. The method offers few challenge to the teachers and not much fund is required, as more often than not the only aid that is required is the blackboard

- Lecturing is inexpensive, flexible and adaptable to a range of audiences; hence it is economic with respect to time, material, resources and man power.
- The method is very convenient, easy and attractive.
- Compared to other methods; it is a highly efficient method if one plans to present the teaching material in a very systematic and logical manner.
- Students can be made aware of voluminous information in comparison with other methods of teaching. This is so because much information can be supplied to the students in a short time.
- Develop quality of listening in the students

Limitations/ Shortcomings of lecture method:

- It does not promote meaningful learning of science as it appeals to only the senses of hearing as more effective learning goes on when many senses are involved. Only hearing can easily lead to forgetting.
- It does not cater to the needs of heterogeneous group of students commonly found in classroom.
- If does not help in achieving the main objectives of teaching of science.
- It is against the psychological principles of learning where students are the passive learners and teacher is the active speaker.
- The rate of imparting information by the teacher may be too rapid for the learner to get necessary connections of thoughts.

Guidelines to implement in the class:

- Teacher should have continuous interaction with students while lecturing.
- Try to involve your students by asking questions which provoked their critical thinking.
- It should be used to develop concepts and should be directed to principles and generalizations.
- A well planned lecture can be most effective method for imparting factual data and theoretical content.
- To maintain interest of students, teaching learning aids could be used during lecture.
- If possible teacher should avoid depending solely on lecture method while teaching science rather it is to be used in combination to discussion, historical or any other method.

Examples:

- Any new and abstract topics

- Topics with historical backup can be taught effectively.
- Topics where lots of data and facts involved

Lecture- Demonstration Method

This method is used in combination of lecture method to take advantages and cater to the shortcomings of it and considered superior than lecture. At the hands of a capable teacher, this method can capitalize on most of the strength of both the lecture and demonstration methods. Through subtle integration of the two methods, a teacher is able to reduce their limitations considerably.

Students do not learn science through either lecture or demonstration used in isolation. A first class demonstration does not guarantee learning science without proper explanation. Lecture-cum-demonstration method succeeds to a limited extent only when lecturing is based upon concrete experiences from the child's environment and the demonstration brings into sharp focus varied aspects of scientific phenomena, and when exchange of opinions between the teacher and pupils goes on in a open atmosphere. In this method teacher performs the experiment in front of the class and simultaneously explains what he is doing. He also asks relevant questions from the class and students are informed to observe carefully and record the procedure and observations. Through questioning and cross questioning the inference is drown by the students and teacher gradually link the explanation and starts lecturing about the already shown concept.

Advantages of Lecture cum Demonstration method

- It is economic in terms of time and money compare to the laboratory method.
- It is psychologically based because the students are shown the concrete things.
- This method is especially useful where: the experiment involves costly apparatus, danger and difficult and complex operations.
- It leads the students towards inquiry when they observe the demonstration and derive some conclusion.
- It also makes the students aware about the procedure of carry out the experiments so as to motivate them to carry out it by themselves.

Limitations of the Lecture cum Demonstration method

Demonstrations are not a substitute for laboratory exercises.

- Some phenomena are difficult to demonstrate in a manner that is visible to an entire class.

- Some time failure in demonstrating in front of the class lead to confusion in the minds of students.
- It does not provide opportunity to the students to carry out experiments as in laboratory method.

Guidelines for the demonstration

- In order to carry out this method teacher should have thorough understanding in the concepts to be demonstrated with the scientific explanation, procedure and the required materials and equipments. Proper planning and rehearsal is required for confident and accurate presentation.
- Teacher should be clear with the purpose of demonstration.
- It should result in the active participation of students of teacher and student both.
- It should be visible to all the students in the class.
- It should be in accordance with the time, resources and age range of the students in order top have meaningful learning.
- It should be simple and speedy.
- While demonstrating in the class teacher should ask questions related to the concept and focus students' attention towards demonstration.
- Clear instruction about the observation should be given for recording the observation.

HISTORICAL METHOD

Historical method of teaching science developed out of a concern that although each citizen would not be expected to become a scientist, each citizen should have some understanding of the role science and scientist play in determining public policy and public resources. In this method students are exposed to a series of case histories which attempt to show how to context, concepts, processes, and individual creativity of scientists have combined to establish what is known as the "structure of the scientific disciplines." Although the method frequently includes verification of historical experiments, the focus of the curriculum is to examine the many aspects of the processes of science rather than to experience them, as would be the case with the heuristic method. Real sense of science, scientific attitude and appreciation can be effectively demonstrated and developed among pupils by unfolding the actual story of great discoveries in a concrete and lively manner. Even the crude attempts made at forming hypotheses, setting up control experiments and narrating differences can be informative

Advantages of historical method

- Science is viewed in this method as an evolving area of study which is more tentative and subjective than most people realize.
- Science can be viewed as a significant humanistic endeavor which makes significant contributions to society as a whole at the same time pursues knowledge and understanding of a very specialized and narrow scope.

Limitations of historical method

- Relevant historical materials are not available for many concepts; particularly those which include the historical aspects of scientific discoveries
- It is a difficult job for a science teacher to link the past thinking in science to the current thinking when they them selves many not have studied the history of science eat depth during their under graduate days.

Guidelines for the implementation:

- Teacher should have intensive reading, communication and articulation ability to arouse interest of the students in the history of science.
- Teacher should have knowledge about references related to the concepts and some other literature for further reading.
- Using this method in combination to lecture or some other method can be more feasible and effective.

Discussion method

Discussion is an effective method of teaching science where content is general and students have some understating to it and cannot be easily deal with limited timing through lecture. In this method topic for discussion is announced to the students well in advance. Teacher provides introduction to the topic and related references are suggested to the students. Students are required to go through the suggested references and make a brief notes on the suggested topics. In the next class teacher divides the class in either different sections or groups of five or four depending on the number of students in the class. Students discuss the topic with the peers in group. They may be given some thought provoking questions to be answered related to topic to have focused discussion. Students are given time to present their views and ideas they have arrived at. This can be done by appointing a leader from one group. Groups can be given name to develop group feelings. At the end teacher will summarize the discussion to generate common understating.

Advantages of discussion method

- The topics can be discussed intensively if focused and lead to meaningful understanding in students.
- It has long lasting impact on students mind and retention is more.
- It is interesting and develops social skills like tolerance, acceptance, communication, cooperation etc.
- Self study skills are developed in students.

Limitations of discussion method

- If students are not motivated for the focused work it turns into wastage of time.
- It is time consuming compared to the lecture method.
- Teacher's inability to divert students' mind for the focused topic and resolving ambiguity can lead to chaos and mismanagement in the class.

Guidelines fro teacher

- Encourage the timid, restrain the talkative, and maintain a standard of discipline in keeping with the maturity level of the students.
- Be willing to accept, temporarily, an incorrect idea. A hasty "No!" or' 'You're wrong!" can bring sudden death to any discussion. Avoid expressing your own ideas until the students have had ample opportunity to express theirs.
- Summarize the discussion at intervals. Use the chalkboard for this purpose.
- Give due credit to the students for their contributions.
- Clear up misunderstandings and emphasize correct ideas.

PROJECT METHOD

This method chiefly consists of building a comprehensive unit around an activity which may be carried on in the school or outside the school. The term project means separate following of individual problems by students or small group of students over a period of few days and such problems may include several sub problems. The project means something planned or a plan for the scheme or an undertaking. Kilpatrick defines project as a "whole hearted purposeful activity proceeding the social environment". Others consider it:

1. A problematic act carried to completion in its natural settings.(Stevenson and charter)
2. A bit of real life that has been imparted into the school.(Ballard)
3. A unit of activity in which pupils are made responsible for planning and purposing.(Parker)

The project method relies heavily on students' interest and socio-economic problems which might be addressed via science. This method is based on students trying to understand and perhaps resolve some problem or conflict which impacts them. In a sense it is a problem solving method, which approaches real problems in their social and environmental context. This is the most advocated but least practiced method in science teaching in secondary schools in developing countries. The use of project method helps to achieve the varied outcomes of science teaching, the reason being that it is an activity method of study which capitalizes on the children's natural tendencies.

Steps of project Method

(a) Providing a situation: situation should create some problems for them and in which they feel interested to work

(b) Formulating objectives: students should be motivated to formulate the problem and its objectives to propose the project in a systematic way in order to have real and workable project. Purpose of project should be clearly defined and rationalized in social context

(c) Planning: students are directed to plan for the project with all the possible alternatives in mind. Every students may have different views and approach to planning a project. Here can provide some guidelines to them if needed. Planning includes work distribution, time, resources and financial budgeting.

(d) Execution: as per the planned schedule and their interest students will carry out their assigned task. This is the longest stage of project. Teacher guides the students in the case of some quarries and difficulties

(e) Evaluation: students will have a retrospection on the whole process to check the mistakes if any to have self evaluation habit.

(f) Reporting : As per the decided schedule all the students will report to the teacher.

Guideline for the teacher:

Divide the students in such a manner to have combination of high Achievers, low achievers and moderate. Teachers' role is very crucial in the success of any project. Teachers must not dictate what is to be done but must encourage initiative. He must let pupils plan what to do and then decide who is to do it. If obvious errors are made, he must decide whether he should step in at once, or let his class learn by experience. He can suggest books to read or consult, places to visit, people to ask and so on. He must tactfully help in ensuring that the proposed plan is possible and he must help to work out a schedule of times and duties.

Advantages of project method

- All psychological principles are followed in this method.
- It imbibes the spirit of cooperation in students
- It develops self confidence and self interest.
- It puts challenge to the students and thus stimulates constructive and creative thinking.

Limitations of project method

- It is an expansive method in terms of time, money and resources.
- The teacher has been assumed as a master of the entire subject and if teacher fails in doing so it turns into worthless activity.

Types of various projects

1. Investigatory projects 2.Confirmatory projects 3.Drill projects

HEURISTIC METHOD

Heuristic method is a method of teaching which involves our placing the students as far as possible in the attitude of a discoverer. The word heuristic is derived from the Greek word heurisco which means 'to find out of", "euriskein" means to discoverer. So any method which excites children to work and think for themselves can be called heuristic method. It follows all the psychological principles such as freedom, experience, learning by doing, purposefulness, play-way, logical thinking, cooperation etc.

A problem is assigned to the classroom and each child is made to feel responsible for finding out something for him self. Each child tries to acquire information about the problem from different sources; classmates, experiments, library, discussions etc. the teacher should stand for the help but should not reply the questions but should facilitate the process of inquiry. In this way the students are led to reason from observation and their powers of observation, experimentation, reasoning etc are developed .They learn how to attack a problem, gather data, interpret the data, formulate the tentative solutions and then arrives at desired conclusions.

Merits of heuristic method

- It develops scientific and positive attitude, spirit of inquiry for science.
- Students become self dependent, self reliant and self confident.
- Habits of industry and hard work are encouraged.
- Future scientist can be evolved out of this training.

Limitations of heuristic method

- Expecting the children to discover something is too higher for them.
- It is very slow process and no surety about the achievement of the objectives of teaching.
- Can not be employed for the larger class strength.
- It is not economical method.

Guidelines for the teacher

- Plan the investigation considering age and abilities of students.
- Teachers should have adequate references on hand.
- Teacher has to demonstrate the spirit of inquiry, interest and curiosity in order to motivate the students.
- Teacher should be a guide, working partner and a friend of students.
- Teacher has to provide conducive classroom climate to encourage spontaneity, self expression and confidence of the students.

ASSIGNMENT METHOD

The whole of the prescribed course is divided in to a number of well connected portions to be covered in a week or so, and are called as assignments. The assignment method is best suited because it involves a harmonious combination of training at the demonstration table and individual laboratory work. In this method the given syllabus is split into well planned assignments with a set of instructions about solving the assignments. Two types assignments can be used for secondary and higher secondary level.1) Home assignments 2) school assignments. It should attempt to achieve the objectives of science teaching which can not be achieved in regular classroom teaching. It should develop interest in the students for science learning.

Criteria of a good assignment:

- An assignment should be in relation to the topic under discussion.
- It should be brief and to the point.
- It should be clear in the purpose, flexible and change according to the situation.
- It should stimulate the students thinking and provoke their thoughts.
- It should suit to the students' age, intelligence, interest abilities.

Merits of the assignment method:

- It develops self study habit in student.

- It synthesizes various methods of teaching science and makes the learning process very effective.
- It provides the students an opportunity to learn at their own pace.
- Train students for self responsibility, creativity and originality.

Limitations of assignment method:

- Success of this method depends on the availability of rich library and laboratory facilities.
- Weaker students need a lot of help and guidance at individual level.
- Suitable for the smaller group of students.
- It is a slower process and a heavy syllabus may not be finished in the limited time.

Annexure 16

Outline of B.Ed. Programme
Department of Education
Faculty of Education and Psychology
The M S Univerisity of Baroda , Vadodara

Duration of the Course (O.B. Ed. 2) :
A candidate admitted to the B.Ed. Programme shall undergo a regular course of study for one academic year, that is, two semesters.

The Courses (O.B.Ed. 3) :
The total credits of the entire B.Ed. programme (A501 to A508, B501 to B515, C501 to C515, D501 to D504, E501 to E504, and Viva-voce) will be 46.

(A) Compulsory Courses

The following Eight Courses are compulsory.

Course No.	Title of the course	No. of Credits
A 501	Principles and Techniques of Teaching	2
A 502	Classroom Management	2
A 503	Educational Psychology	2
A 504	School Organization and Management	2
A 505	Educational Evaluation	2
A 506	Education in Emerging Indian Society-I	2
A 507	Education in Emerging Indian Society-II	2
A 508	Information & Communication Technologies in Education	2

(B) Special Fields

Each candidate will select anyone of the following courses to be offered in Semester II.

Course No.	Title of the course	No. of Credits
B 501	Better School Examination	2
B 502	Educational and Vocational Guidance	2
B 503	Value Education	2
B 504	Institutional Planning and Advanced School Administration	2
B 505	Yoga Education	2
B 506	Health Education	2
B 507	Education for Leadership and Motivation	2
B 508	Educational Technology	2
B 509	Environmental Education	2
B 510	Curriculum Development	2
B 511	Special Education	2
B 512	Humanistic Education	2
B 513	Computer Education	2
B 514	Futurology in Education	2
B 515	School Magazine : Designing, Development and Dissemination	2

(C) Special Methods

Each candidate will offer any two of the following methods which will be of two-semester duration.

Course No.	Title of the course	No. of Credits
C 501	Teaching of English	4
C 502	Teaching of Gujarati	4
C 503	Teaching of Marathi	4
C 504	Teaching of Commerce	4
C 505	Teaching of Psychology	4
C 506	Teaching of Mathematics	4
C 507	Teaching of Science	4
C 508	Teaching of Physics	4
C 509	Teaching of Chemistry	4
C 510	Teaching of Biology	4
C 511	Teaching of Hindi	4
C 512	Teaching of Sanskrit	4
C 513	Teaching of Social Studies	4
C 514	Teaching of Accountancy	4
C 515	Teaching of Economics	4

(D) Practice Teaching :

All the following four courses are compulsory.

Course No.	Title of the course	No. of Credits
D 501	Journal of Practice Lesson Plans	1
D 502	Records of Lessons Observed	1
D 503	Practice Lessons given	6
D 504	Final Test Lessons	4

(E) Practical Work

Each candidate will do the practical work on the following themes :

E 501	Preparation of Assignment	1
E 502	Developing Teaching Aids	1
E 503	Preparation of Blue-Print & Evaluation Items	1
E 504	Developing Written Instructional Materials	1

Viva-Voce Test

B.Ed. candidates will undergo two Viva-Voce Tests :

(a)	Internal Viva-Voce Test	2
(b)	External Viva-Voce Test	2

Attendance (O.B.Ed. 4)

Every candidate must have 80% attendance in each of the courses.

Scheme of Evaluation (O.B.Ed. 5)

(i) The performance of each candidate in all the courses will be evaluated on

eleven-point scale in terms of grades ranging from E to A+. The details regarding grade along with its grade points and equivalent range of percentages and class are as under:

Grade Point	Grade range	Grade point	Percentage	Class
A+	10	9.56 to 10	96 to 100	First Class with Distinction
A	9	8.56 to 9.55	86 to 95	First Class with Distinction
A–	8	7.56 to 8.55	76 to 85	First Class
B+	7	6.56 to 7.55	66 to 75	Second Class
B	6	5.56 to 6.55	56 to 65	Second Class
B–	5	4.56 to 5.55	46 to 55	Pass Class
C+	4	3.56 to 4.55	36 to 45	Pass Class
C	3	2.56 to 3.55	26 to 35	Fail
C–	2	1.56 to 2.55	16 to 25	Fail
D	1	0.56 to 1.55	06 to 15	Fail
E	0	0.00 to 0.55	00 to 05	Fail

(ii) If the grade point is in decimals. The following rounding off procedure will be practised. Value of decimals of O.56 or more should be considered as the next higher integer e.g. a gradepoint of 5.55 will be considered as 5 whereas a gradepoint of 5.56 will be considered as 6.

(iii) The Grade (mark) Sheet will contain separate grade for each of compulsory papers, special field, teaching of methods (both), practice teaching, practical work, viva-voce and an overall grade of all the courses combined. It will also contain percentage and the class obtained The percentage will be calculated on the basis of average grade points obtained by a candidate.

(iv) The transcripts will contain course-wise grade in theory, practice teaching, practical work, average grade of internal and external viva-voce and an overall grade. It will also contain the percentage and the class obtained. The transcript will be available in the faculty office on written request by paying the prescribed fee.

(v) The student's overall grade will be the average grade obtained in different courses as illustrated below :

Course No	No. of Credits	Grade	Grade Points	Total Credit
A 501	2	A–	8	8 x 2 = 16
A 502	2	B+	7	7 x 2 = 14
A 503	2	B	6	6 x 2 = 12
A 504	2	B–	5	5 x 2 = 10
A 505	2	A	9	9 x 2 = 18
A 506	2	B	6	6 x 2 = 12
A 507	2	C+	4	4 x 2 = 08
A 508	2	B+	7	7 x 2 = 14
Method I	4	B	6	6 x 4 = 24
Method II	4	B	6	6 x 4 = 24
Sp. Field	2	B	6	6 x 2 = 12
D 501	1	A–	8	8 x 1 = 08
D 502	1	A–	8	8 x 1 = 08
D 503	6	B+	7	7 x 6 = 42
D 504	4	B+	7	7 x 4 = 28
E 501	1	A	9	9 x 1 = 09
E 502	1	A–	8	8 x 1 = 08
E 503	1	B+	7	7 x 1 = 07
E 504	1	B	6	6 x 1 = 06
Viva-Voce	4	B	6	6 x 4 = 24
	46			304

Average Grade Point = 304/46 = 6.61 = 66.1%
Overall Grade = A–

1.Theory Course :

The performance of students in theory courses (A 501 to A 507, A 508 B 501 to B 515, C 501 to C 515) will be judged on the basis of periodical tests, fieldwork, assignment, comprehensive test, etc. A comprehensive test will be conducted by the end of each semester in each of the courses taught during the semester. This test will be based on the whole course covered during the semester. The comprehensive test in each course will have the same weightage as of the sessional assessment covering periodical test, fieldwork, assignment etc.

2. Practice Teaching :

(i) The performance of the candidate in D 501, D 502, D 503 and D 504 will be graded by assigning letter grade only.

(ii) The panel consisting of internal as well as external examiners shall be appointed by the Vice-Chancellor to examine the final test lessons (D 504) which will be conducted in the second semester.

3. Practical Work :

The performance of the candidate on each of the four practical work courses (E 501 to E 504) will be graded by assigning a letter grade only.

4. Viva-Voce :

Two viva-voce tests shall be conducted. Both the internal as well as external viva-voce tests will carry equal weightage and will be assigned letter grade separately.

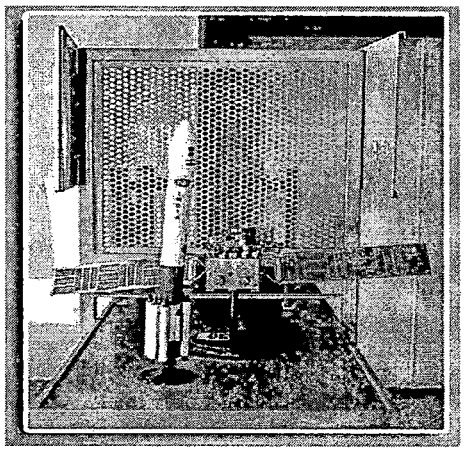
(i) Internal Viva-Voce Test : The internal viva-voce test shall be conducted at the end of the first semester by a committee of teachers appointed by the head of the Department of Education. The viva-voce test will focus on the candidate's understanding of his/her knowledge of the first semester courses offered by him/her, i.e. theory courses, practice teaching, practical work, etc.

(ii) External Viva-Voce Test : The Board of Examiners consisting of three internal and three external (at least two members) shall be appointed by the Vice-Chancellor to hold a viva-voce test of each candidate at the end of the second semester. The viva-voce test will focus on the candidate's understanding of both the semester courses, current educational problems and issues in the Indian context.

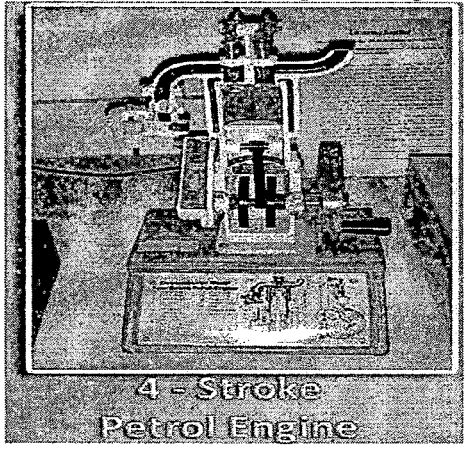
Annexure 17

Few exhibits on science concepts covered at Community Science centre

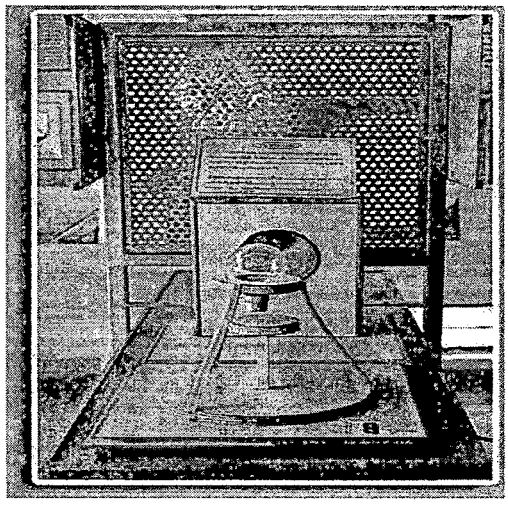
A. Rocket and satellites



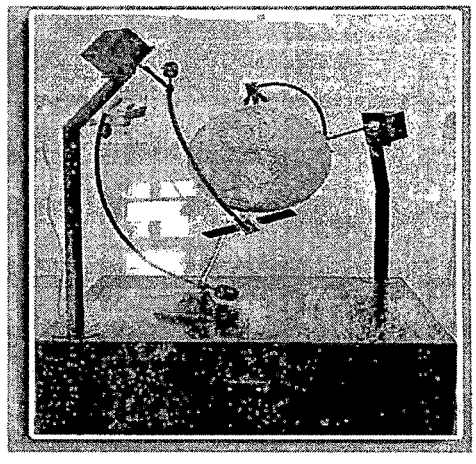
B. A complete model describing the working & the 4 stroke petrol engine



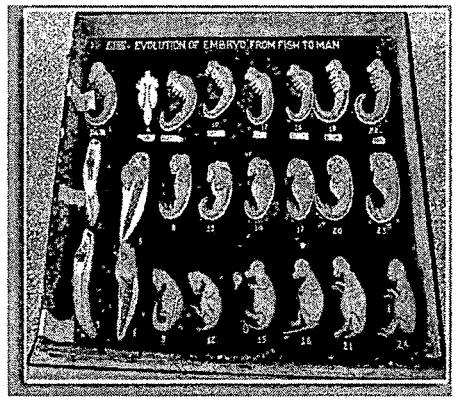
C. A simple model of microscope



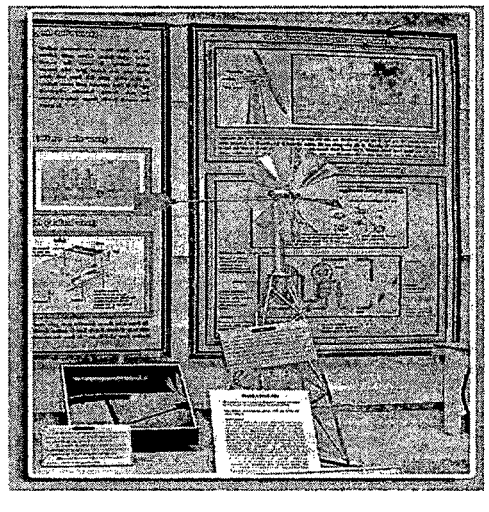
D. A complete model of geostationary Satellites and other satellites around the earth.



E. Models of evolution of life



F. Model of wind mill



1) TRANSFER OF MOMENTUM

This exhibit demonstrates in an interesting way the principle of transfer of momentum by a group of five balls. When one ball was released only one ball got displaced. Similarly when two balls were taken to the top and released, two balls got displaced.

2) SIMPLE MAGNIFYING GLASS

It was nicely shown how to prepare a simple magnifying glass with the help of glass bulb and water. A glass bulb was filled with water and when anything was kept below it and seen, it was seen enlarged and magnified.

3) FOUNTAIN OF BALLS

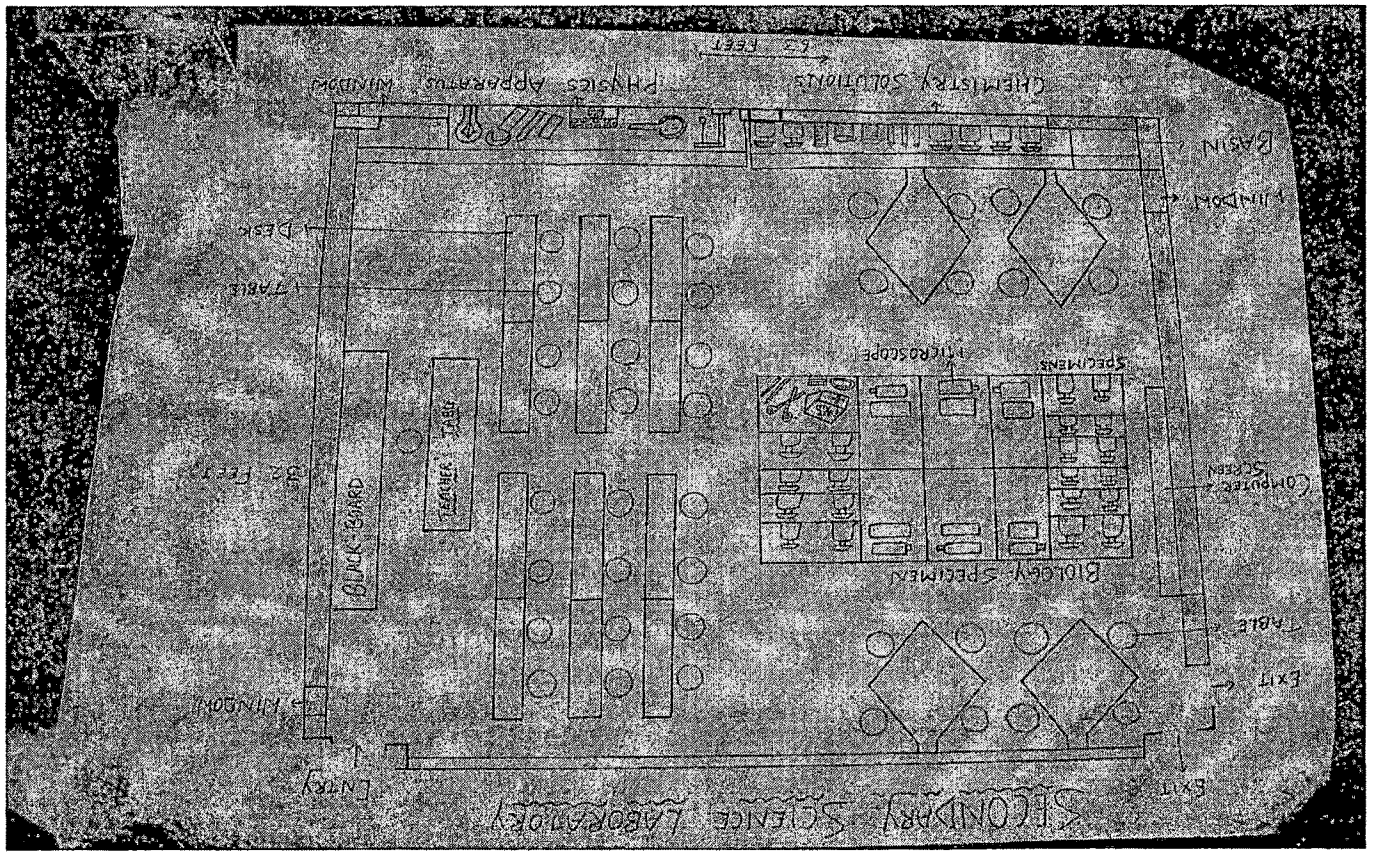
There was a fountain of balls which worked on the sound principle. When any sound was made near it, it started working and there was a fountain of balls and the next time when any sound was made near it, it stopped. This is the same principle which is applied in various games, appliances, etc

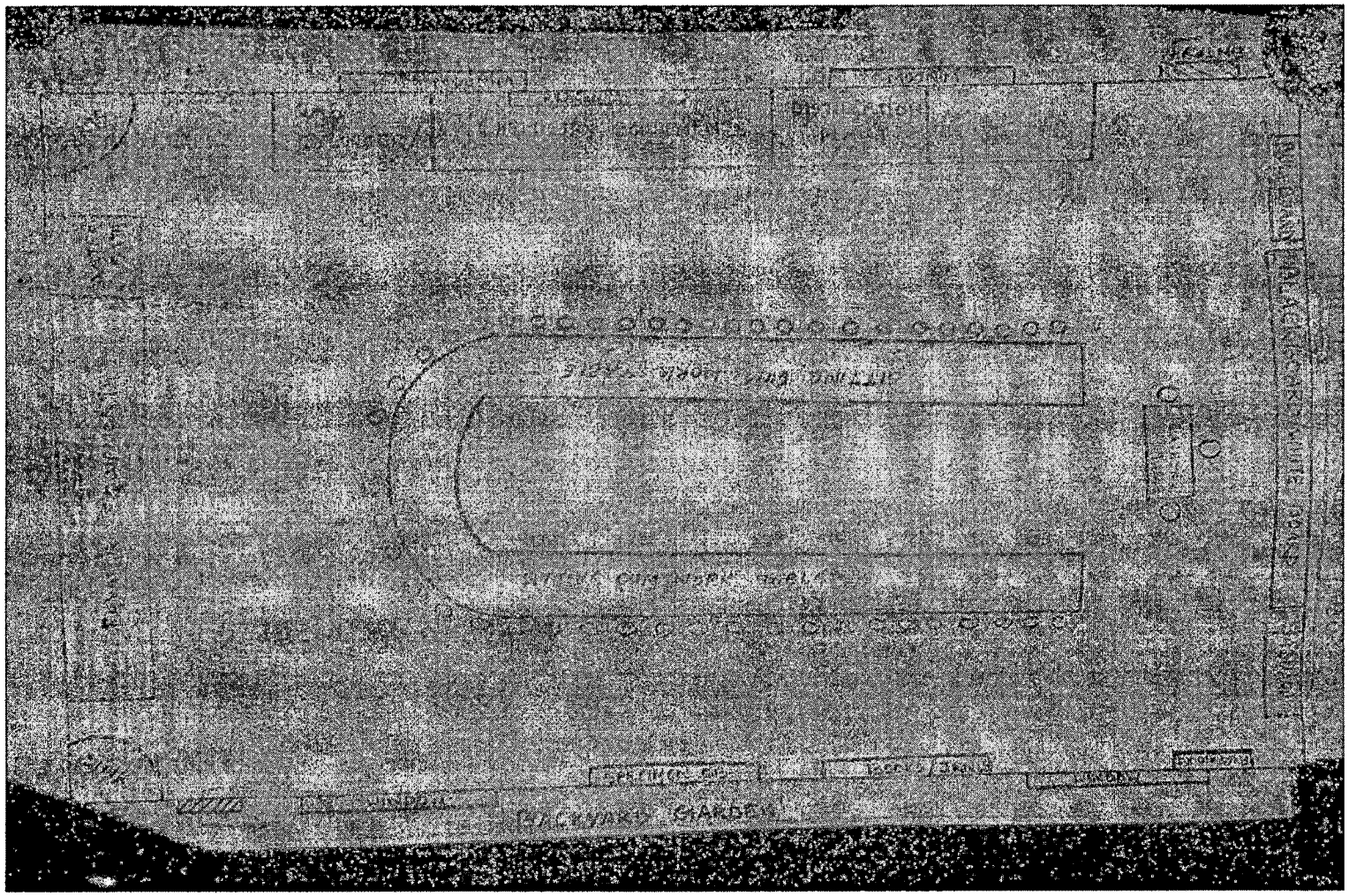
4) REFLECTION MAZE

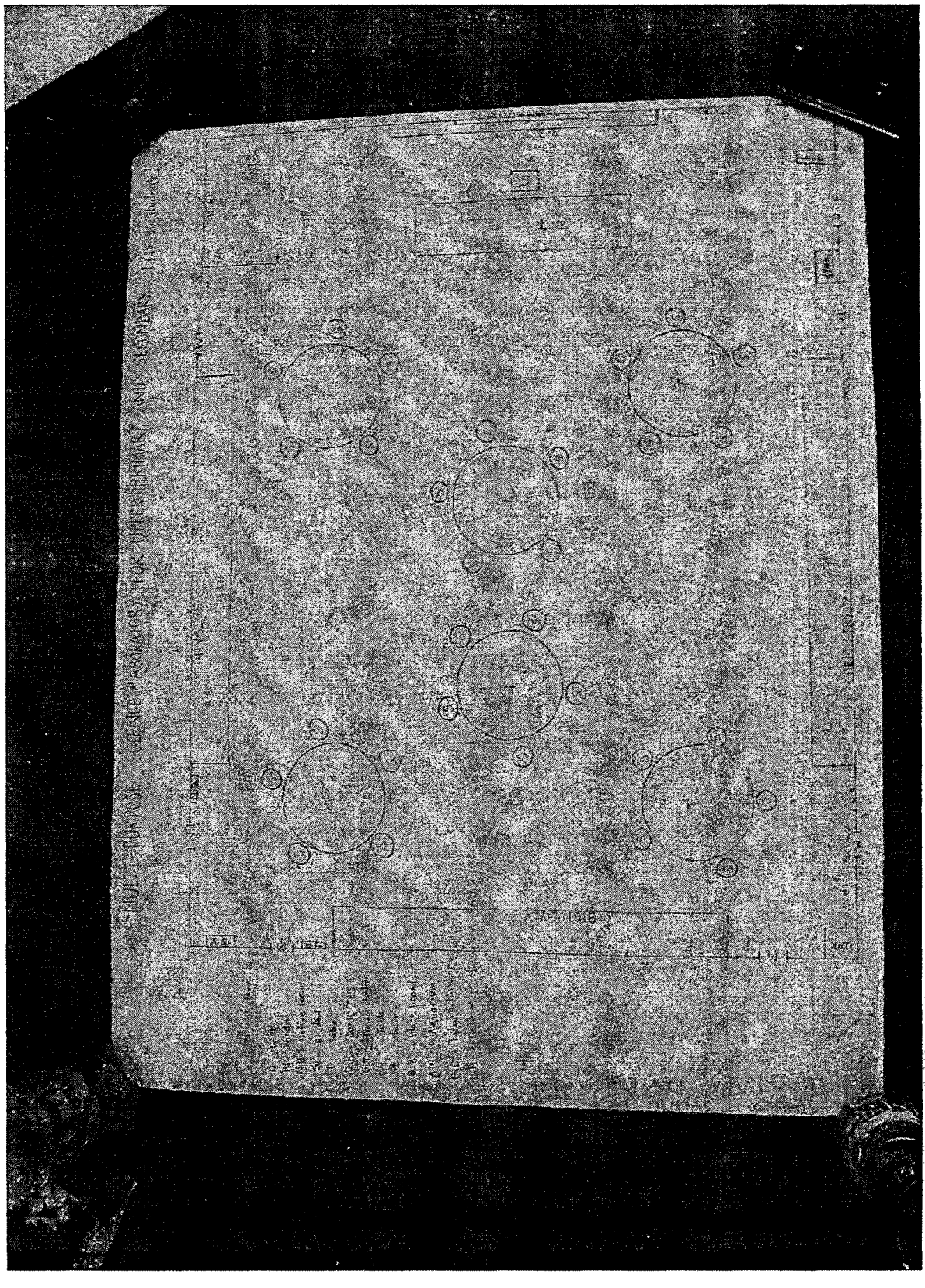
This is one of the most wonderful application of mirrors arranged at specific angle due to which a maze of reflection was formed. Mirrors were arranged in such a way there were infinite reflections seen. When I stood in from of it, my infinite mages were seen which was simply unbelievable.

Annexure 18

Lay out plans of multi purpose science laboratory for secondary schools prepared by the student teachers







Annexure 19

A list of TLM prepared by student teachers for VIII and IX grade science and technology subjects

Standard VIII Science and Technology

Sr. No	Lesson	Experiments/Models	Equipments
1	Universe	Universe's model	To make model we need cardboard, coloured plastic, balls, fevi stick, sketch pens to draw orbits satellites on charts.
2	Soil	Formation of soil	Specimen of types of soil
		Soil profile	Soil brorer
		Study of different particles of soil	Specimen of particles of soil
		Check soil's water absorbers capacity	Stand, funnel, beaker, Measuring flask, different types of soil, filter paper,
		Check soil's erosion by water	Activity, giving live experience
		Check fertility of soil's	Different types of soil, pot, seeds, water, long process can be given as home assignment.
		Check soil erosion by air	Activity, giving live experience
3	. Air	Production of oxygen,	Water potassium chlorate (Cro_3) manganese dioxide (MnO_2), sodium peroxide (NaO_2)
		Chart of nitrogen cycle	Chart paper, sketch pens
		Greenhouse effect chart	Chart paper, sketch pens
4	Cellular organization	Plant cell	Model of plant cell
		Animal cell	Model of animal cell
		Onion cell	Microscope , methylene blue, or saffrenine , dissection

			box, glycerin, onion
		Chick cell	As per onion cell study, portion of chicks using spatula.
5	Transformation of matter	Endothermic reaction	Calcium carbonate ($caco_3$), burner ,test-tube, matchbox (to check CO_2)
		Exothermic reaction	Water , refrigerator
		Fractional crystallization	$KMnO_4$ .potassium permanganate, salt , water
		Distillation (To obtain distilled water)	Thermometer, wire gauge, stand, burner, distillation flask, tripod, cork, radiator, flask, water
		Precipitation	Sodium chloride, silver nitrate,
		Neutralization	NaOH, Hcl, Blue and red litmus paper
6	Metals and Non metals	Physical properties of metal	Copper glass, bell copper wire, $Na_{(s)}$, burner, wax, nail, tester
		Physical properties of non-metal	Pencil
7	Carbon	Burning various things like paper, cotton, sugar etc. to show the presence of carbon.	<u>Materials</u> Crystal , pencil lead (graphite), charcoal test-tube, gas jar, bent glass/plastic tube litmus paper (blue/red), match sticks candle, burner
		Preparing CO_2 in laboratory.	
		Showing the presence of carbon and hydrogen in candle wax.	<u>Chemicals</u> CaCO3, Dilute HCl, Ca(OH)2, CH3COONa, NaOH CaO
		Preparing methane in laboratory.	
8	Structure Of Atom		periodic table model of structure of atom

9	Refraction of light	Experiment to understand the phenomenon of refraction (bending of pencil in glass of water, marbles in water etc.) refraction of light by observing line through a glass slab showing dispersion of light through prism Image of candle / object with the help of convex lens. Use of drop of water as convex lens Preparing simple telescope.	glass tumbler, pencil, marbles, glass container glass slabs (4- 5), prisms (4 – 5), concave lens convex lens , simple microscope , ruler, pins compound microscope, candles, torch, chart or model of human eye

Standard ix: science and technology

Chapter no	Name of the chapter	Experiments/activities /models/charts possible	Equipments/materials/apperatus/ chemicals/ other requirements to corresponding acitivities
4	Gravitation Free fall Mass and weight projectile motion	Take some solid objects like ,balls, coins etc Take some light objects like paper and some coins or small stones take some solids described as above balance for weight measurement cricket ball	
5	Work, Energy And Power Kinetic energy Conversation of energy	Work :we can provide activity to the students tell them to think some situations from their daily life invoving work and discuss with them Relation between work,displacement and angle Tell students to list some activities and gadgets involving conversation of energy and discuss	string, toy car wet sand bed,ball rubberband,toycar,bow made up of bamboo stickcertain solid objects

6	Heat	Measurement of temperature Transfer of heat. State of matter and their conversion Evaporation. Relative humidity.	Thermometer, beaker, stand, burner Iron rod, pin, wax Thermometer, beaker, ice, stand, burner, stop watch. Beaker, glass case, evacualed vessel, water. Cold water, steel glass
7	Wave, Motion And Sound		Stand, spring, different weight Stand, Pendulum, stop watch String Tunnig forks,beaker filled with water
8	Properties f Matter.	Classification/ Physical properties of matter Elements, compounds and mixtures. Different types of mixture. Homgeneous Mixture. Heterogeneous Mix Colloidal solution	Different types of vessels solid, liquid, gas, incense stick, ballon. sugar water, Mg ribbon, Nacl. Two china dish, sulphur powder, Cu cuttings, crucible. salt, sugar, water, beaker, glass rod. saturated) stand and burner. Oil and water, beaker. milk, torch, beaker
9	Atomic structure		chart which shows discharge tube with discovery of electron Thomson's atomic model chart of elements with their vacancies models showing arrangement pf electrons in orbits
10	the periodic classification of elements		chart of modern periodic table
11	Chemical Bonds	Activity: Melting point of NaCl, Boiling point of NaOH.	Chemicals NaCl, NaOH Apparatus Paraffin Tube, Thermometer, Glass tube

			Materials: Chart of Mendelif's Periodic table, Model of Crystal Structure of NaCl, Models of ionic bond, Polar covalent bond and covalent bond
12	Chemical Reactions	Invisible Ink	Chemicals: Lead Nitrate, Lime Stone (Calcium Carbonate), Copper Sulphate, Iron, Barium Chloride, Sodium Sulphate Apparatus: Test tubes, Bunsen Burner, Holder Materials: Matchsticks, Chart of Oxidising and Reducing agent, lemon juice
13	Coal & Petroleum	To show decomposition reaction of CaCO3, Destructive distillation of Coal	Chemicals: Kerosene, Wax Apparatus: Test tubes, Burner, Test tube stand, Beaker, Conical flask, stand Materials: Litmus paper (Red and Blue), sand, Porcelain pieces
14	Cell and Cell Structure	To study plant cell and animal cell	Chemicals: Stain (Methylene blue), Iodine Apparatus: Microscope, Slides, Cover slips, forceps Materials: Slides of animal cell and plant cell, chart of structure of bacteria and virus, chart of differences between animal and plant cell, chart of mitochondria, endoplasmic reticulum, lysosome, chloroplast, Model of plasma membrane, golgi body, Onions
15	Cell Division	Meiosis, chart of difference between mitosis and meiosis.	Chemicals: Stain Apparatus: Slides, dehydration tray, cover slips, watch glass, microscopes, brush, rubber pad Materials: Onions, blotting paper, slides of different phases of mitosis and meiosis, Models of different phases of mitosis and

16	Plant Tissues	To demonstrate conductivity of water through xylem, to demonstrate the function of xylem	Chemicals: Stains Apparatus: Microscopes, slides, cover slips Materials: Slides of plant tissue (parenchyma, collenchyma, sclerenchyma, xylem, phloem), chart of classification of plant tissue, plants like hydra, valisneria, leaves of mango, asopalav, chickoo
17	Animal tissues	Cheek cell experiment. Demonstration of Blood cells.	Slides, microscope, toothpick, coverslip, methyleneblue. Lancet, alcohol, slides, microscope, leishman stain, water, cotton, Burner. Slides of all Animal tissues.
18	Classification of Plan	Visit to a Botanical Garden.	Specimens of plants- ranging from bacteria till gymnosperms.
19		Specimens of Animals – ranging from protozoa to mammalian. Visit to a Zoo. Demonstration of Lactobacillus.	Curd, saffranin, iodine, burner, crystal violet, microscope, slides.
20	Food, Nutrition and Health	Confirmatory test for presence of starch, sugar, fat. Demonstration of water filtering in rural areas.	
21	Human diseases		Pictures of diseases and disease causing organisms.
22	Our Natural Resources	Explaination of 'Green House Effect' with its chart or animation pictures Visit to an industry (for awareness of pollutants) Explanation about Extinct and Endangered species with power point presentation Visit to National Park and sanctuary	
23	Food Resources: Crop production System and Sustainable agriculture	Visit to a farm Illustration of plant disease with the help of power point presentation Showing diseased plans	Plants specimens

24	Food resources: Animals	Chart explaining Nutritional Values of animal Food products Expaination about Indian cows and Exotic cows with the help of power point presentation Visit to animal shelter for explaining, "Shelter and Feeding management of domesticated animals". Visit to a place of Poultry Farming. Explaination of fish farming with aquarium
25	Habitat and Adaptation	Showing the students models of plants of fresh water habitat like Hydrila, Vallisneria, lotus, Typha, Ceratophyllum. Showing the students models of sea flora like diatoms, dinoflagellates, various kinds of algae. Showing the students models of aquatic animals like Amoeba, Paramecium, Grantia, Hydra, Bivalve, Leech, Fish, Frog. Visit to Zoo for giving information about Forest habitat and grass land animals. Models of Aerial Animals like Bat, dove, sparrow.
26	Biosphere	Making a chart of biosphere and explaining Biosphere using it. Chart explaining "Various tropic levels" Making a model showing structure and function of ecosystem. Making Chart by students of Pyramids of number of (1) Grass and land ecosystem (2) Pond ecosystem (3) Forest ecosystem Making charts of food web in (1) Grass land (2)Pond (3)Complex Food web by students Making chart of Carbon cycle and Nitrogen cycle
27	Blood Donation	Chart explaining blood group and possibility of blood donation Visit to Blood Bank

Annexure 20

A sample of science evaluation item prepared by student teachers

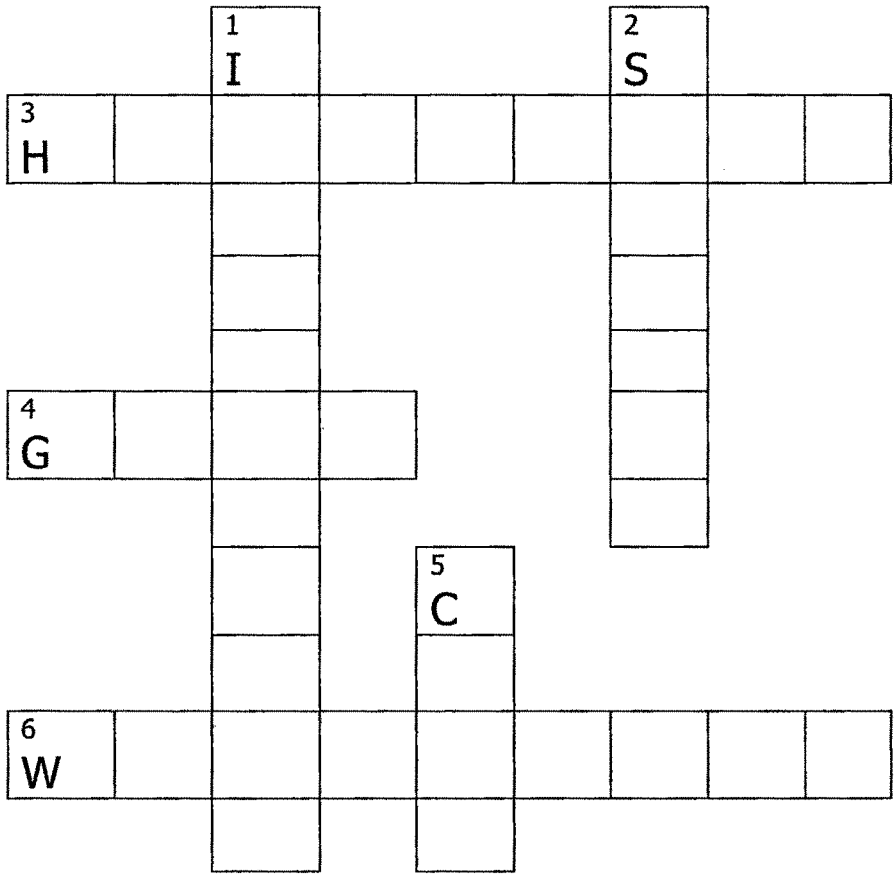
Name : Sonal & Group **Std** : 8th
Chapter: food (crop) production and food (crop) management

Science Puzzle

Complete the following word puzzle with the help of clues given below:

Down:
1. Providing water to the crops.
2. Keeping crop grains for a long time under proper conditions.
5. Certain plants of the same kind grown on a large scale.

Across:
3. A machine used for cutting the matured crop.
4. A rabi crop that is also one of the pulses.
5. A process of separating the grain from chaff.



Roshini mahisuri

A WEEKEND WITH PIXIE

Pixie is a smart and intelligent girl. She likes to keep on experimenting at her home. Let's figure out what she did this weekend.

ON SATURDAY

She passed an electric current through water. She got two gases one which she claims is the lightest gas in the world and the other is the supporter of combustion. Can you identify the gases and summarize what may have happened by an equation?

GAS 1: .....

GAS 2: .....

EQUATION:-

ON SUNDAY

Our dear pixie heated a few pieces of limestone and an amazingly useful gas was produced which our friend confirms it and left a white powdery substance as a residue. I'm confused. Can you be the brilliant one to make a guess?

GAS PRODUCED : .....

PRODUCT OBTAINED :

EQUATION:-

ANSWERS:

ON SATURDAY

GAS 1 : HYDROGEN

GAS 2 : OXYGEN

EQUATION: $2H_2 + O_2 = 2H_2O$

ON SUNDAY

GAS PRODUCED: CARBON DIOXIDE

PRODUCT OBTAINED: CALCIUM OXIDE

EQUATION: $CaCO_3 = CaO + CO_2$

CROSSWORD CRAZE

Seema Prajapati

Complete the space crossword given below, with the help of the given clues.

Across:

2 Dirty ice balls, with the tail of gas, hurtling towards the sun
5 A gigantic exploxion, which finishes off a super giant star.
7 The moon of Saturn infact the only moon with an atmosphere.
8 A belt of rocky lumps that circle around the sun.

Down:

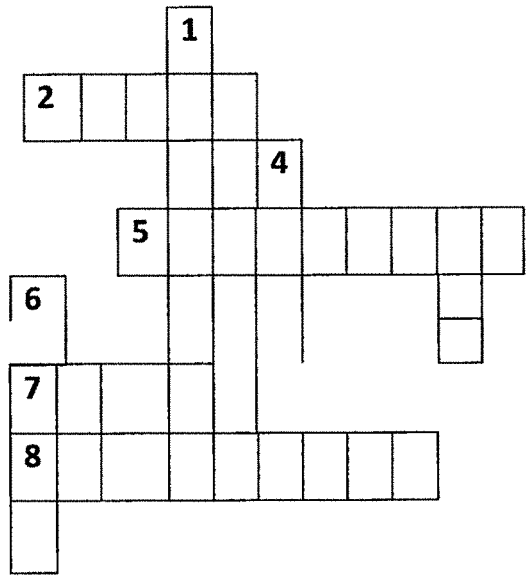
1 Stars are born here.
3 Saturn has these many rings.
4 Mars is also called the .....planet.
6 Sun is medium-sized .....

ACROSS

2 COMET
5 SUPERNOVA
7 TITAN
8 ASTEROIDS

DOWN

1 NEBULAE
3 SEVEN
4 RED
6 STAR


1
2
4
5
6
7
8

Annexure 21

List of skills and qualities which can be developed in students through science teaching as suggested by student teachers before and after the treatment

Table One : skills and qualities suggested by student teachers before the treatment

Analytical skill	01
Accuracy	02
Application ability	03
Asking questions	01
Comprehension ability	07
Confidence	01
Creativity	02
Critical thinking	03
Curiosity	06
Develop drawing ability	01
Decision making ability	01
Discipline	01
Do not west time	03
Environmental sensitivity	01
Friendly and open life style	03
Group work and coordination	02
Habit of verification	03
Imaginative	01
Innovative	01
Increase perfection	02
Intelligence	06
Interest in science	01
Knowledge about sci, tech.	04
Logical thinking	07
Nature loving	01
Observation power	04
Practical knowledge	06
Preciseness	01
Punctuality	02
Rational thinking	03
Regularity	01
Reasoning ability	01
Scientific attitude	02
Scientific mannerism	03
Systematic in work	04

Table Two: skills and qualities suggested by student teachers after the treatment

Analytical skill	01
Accuracy	05
Application ability	07
Activeness	02
Asking questions	00
Communication skill	02
Comprehension ability	05
Confidence	01
Creativity	07
Critical thinking	17
Curiosity	06
Co-operation	01
Decision making ability	04
Discipline	01
Demonstration	03
Do not west time	06
Drawing skills	03
Environmental sensitivity	04
Experimentation	25
Explanation	06
Friendly and open life style	03
Group work and coordination	07
verification	02
Hypothesising	01
Honesty	02
Imaginative	05
Innovative	06
Investigation	01
Increase perfection	00
Intelligence	00
Interest in science	00
Instrumental skill	01
Knowledge about sci, tech.	00
Logical thinking	14
Lateral thinking	01
Listening	01
Managerial skill	01
Nature loving	00
Observation power	35
Open minded ness	06
Organised	01
Practical knowledge	00
Predicting	01
Presentation	02
Preciseness	03
Problem solving	02

Punctuality	04
Proven evidence	01
Positive attitude	02
Questioning	02
Rational thinking	08
Regularity	00
Reasoning ability	08
Role play	01
Scientific attitude	13
Scientific mannerism	02
Systematic in work	01

Annexure 22

List of different ways of learning science suggested by student teachers

Table one: Responses of student teachers before the Implementation of ABSTP

Ways through which science can be learnt	No of Respondent
3d demonstrations on computers	05
Activity	03
By demonstration	10
By doing it practically	12
By explanation	07
By observation	08
Creating curiosity	01
Day today examples	03
Experiments in laboratory	10
Experts talk	02
Field visit	15
Group Discussion	06
Internet	03
Learn by doing	02
Lecture	04
Models related to science	05
News paper reading	02
Presentations	03
Reading books and articals	07
Real life experiences	06
Science club	01
Science fairs	01
Science journals	02
Science museums	01
Seminars	03
Showing videos	03
Teacher student interection	03
Television national geography animal planet discovery	05
Testing	02
Thnking critically	01
Using Teaching aids	06
Workshops	01

Table Two: Responses of student teachers after the Implementation of ABSTP

Ways thourgh which science can be learnt	No of respondent
Activity/ method	02
Assignments	04
Brainstorming	01
By doing it practically	07
Creating curiosity	07
Creative work	01
Day today examples	04
Demonstration	14
Discussion	10
Elders	01
Exhibition	05
Experiments in laboratory	20
Experts talk	00
explanation	00
Field visit	18
Film show	01
Group activity	01
Group Discussion	05
Heuristic	02
Inquiry	01
Internet	01
Laboratory	01
Learn by doing	02
Learning together	01
Lecture	09
Media	03
Models related to science	02
News paper reading	07
observation	14
Play way method	05
Presentations	00
Project	03
Quiz	05
Reading books and articals	09
Reading books of science	01
Real life experiences	09
Role play	10
Science club	02
Science fairs	01
Science journals/magazines	01
Science museums	06
Science poems	02

Scientific puzzles	03
Seminars	04
Showing videos	06
Story telling	03
Teacher student interection	05
Teachers	01
Teaching aids/audio visual aids	04
Television national geography animal planet discovery	10
Testing	09
Textbooks	01
Thinking critically	06
Workshops	08

Annexure 23

Outline of the set of DVDs

There is a set of DVDs appended along with this thesis. This set contains six Volumes. Detail about the content of each of the Volumes is given below

Volume One & Two

Both the volumes contain Student Teachers performances on demonstration/activity of science concepts. Each of the demonstration intends to show the changes occurred in the experimental skills of student teachers before and after the implementation of ABSTP.

Volume **one** contains fifteen clips showing student teachers performance before and after the Implementation of ABSTP.

Volume **two** contains seventeen clips showing student teachers performance before and the Implementation of ABSTP.

Volume Three

It contains the Film "Inconvenient Truth" shown to student teachers to create awareness regarding issues related to Global Warming.

Volume Four

This volume contains visuals on Visits to District Science Centre, Dharampur, Community Science centre, Vadodara, Group discussion on value inculcation, Science laboratory presentations and Workshop on best toys from waste.

Volume Five

This volume contains the video recording of the Role play on "Status of Science clubs in schools of Vadodara city directed and performed by the student teachers.

Volume Six

It contains Power point presentations used by the researcher during the implementation of ABSTP namely Science Process Skills, Development of science teaching and changes in the Objectives of Science teaching after independence and Methods of Teaching.