

# 1. INTRODUCTION

Experiments are a central feature of the scientific method. No theory or law, however refined it may look, is acceptable in science unless it is confirmed by experiment. Experiments are also the primary tool to investigate new domains of nature. Science progresses through a continual interplay of theory and experiment. We are all aware of the great experiments that changed the course of scientific progress: Galileo's experiments on inclined planes and pendula, Faraday's experiments on electricity and magnetism, Lavoisier's experiments on combustion, Mendel's experiments on genetics and Rutherford's experiments on radioactivity, to name a few.

Just as experiments are important for advancement in science, they are equally important for learning science. School science education must, therefore, have experiments as its important focus. Experiments aid learning of science in several ways. First, they convey to the students the right message that science is about the real world around us - it is not just a theoretical subject abounding in formal definitions, formulas and laws. The latter is also important, no doubt; but theory must not stand in isolation - it relates to the real world. Experiments connect the theoretical world of text books to the real concrete world of experience. Second, experience shows that experiments are a way to create interest in science among students. They attract students of a wide range of abilities. Once the interest in the subject is kindled, students begin to take interest in the more theoretical parts of the subject too and thus improve their overall competence in science. Third, experiments promote the basic skills and competencies involved in science: procedural and manipulative skills, observation skills, skills of representing and interpreting data and the accompanying conceptual and critical abilities. For these various reasons, it is widely accepted that school science curriculum must have a strong 'activity and experiment-based' components

The importance of experiments in science education has been recognized in the national policy of education for the last several decades. In practice, however, despite many efforts, experiments have not received their due importance and emphasis in science teaching in our schools. The problem is complex and arises due to a combination of several factors. Two reasons are often cited for the lack of emphasis on experiments in our schools. First, experiments require a certain minimum infrastructure - a laboratory with certain basic equipments, recurring expenditure on consumables, etc. This minimum infrastructure is not always available in all schools in our country. Second, in view of the difficult logistics involved in assessing experimental work for the large number of school students, the assessment of experiments has not been as serious as that for the theory part of the curriculum. What is not assessed externally is usually marginalized in our school system. In short, lack of infrastructure and, more important, lack of proper assessment, have resulted in the unfortunate marginalization or neglect of experimental work in Indian schools.

## 2. THE BOARD'S INITIATIVE

The Central Board of Secondary Education has always been concerned about giving due emphasis to experiments in the schools and has taken several steps in this matter in the past. It tries to ensure that its affiliated schools have the necessary infrastructure to carry out the experiments prescribed in the syllabus for Classes IX and X. To make this feasible for all its schools, care is taken that the laboratory curriculum does not demand excessively costly equipment. In order to strengthen the assessment of practicals for Classes IX and X, CBSE has now decided to take a new initiative aimed at increasing the emphasis of practicals in schools, promoting seriousness in carrying out the practicals, and in making assessment of practicals even more uniform and reliable. Currently, the weightage given to theory and practicals at secondary level is 75% and 25% respectively. Besides, the practical examination is conducted at school level and the marks obtained by every student are indicated separately in the certificate issued by the Board.

As per the new scheme, theory and practical examination will have a weightage of 60% and 40% respectively. The practical examination will comprise of two components. One component of this practical examination will be in the form of a written test, to be conducted by the Board in Class X as an independent paper. This question paper will be of 20 marks and 1½ hour duration. It will aim at testing of practical skills through multiple-choice type questions. Each multiple-choice question will have four options, with only one of them as the correct option. The second component will also have a weightage of 20 marks but will be conducted at school level on the lines being followed presently.

The Board hopes that this initiative will be an important step not only to give experiments their due place in the subject of Science and Technology but also to promote, in general, an experimental culture in our school system.

**LIST OF EXPERIMENTS**  
**SCIENCE AND TECHNOLOGY**  
**CLASS IX**

1. To prepare
  - a) a true solution of common salt, sugar and alum
  - b) a suspension of soil, chalk powder and fine sand in water
  - c) a colloid of starch in water and egg albumin in water and distinguish between these on the basis of
    - i) transparency
    - ii) filtration criterion
    - iii) stability.
  
2. To prepare
  - a) a mixture
  - b) a compoundusing iron filings and sulphur powder, and distinguish between these on the basis of
  - i) appearance i.e. homogeneity or heterogeneity
  - ii) behaviour towards a magnet
  - iii) behaviour towards carbon disulphide (a solvent)
  - iv) effect of heat.
  
3. To carry out the following chemical reactions and record observations. Also to identify the type of reaction involved in each case.
  - i) Iron with copper sulphate solution in water.
  - ii) Burning of magnesium in air.
  - iii) Zinc with dilute sulphuric acid.
  - iv) Heating of lead nitrate.
  - v) Sodium sulphate with barium chloride in the form of their solutions in water.

4. To determine the density of a solid (denser than water) by using a spring balance and a measuring cylinder.
5. To establish the relation between the loss in weight of a solid when fully immersed in (i) water (ii) kerosene, with the weight of liquid displaced by it by taking at least two different solids.
6. To study the variation in limiting friction between blocks of different masses and surfaces of different nature.
7. To measure the temperature of hot water as it cools and plot a temperature-time graph.
8. To study the variation in the time period (T) of a simple pendulum with its length (L) and to plot L-T<sup>2</sup> graph.
9. To prepare stained temporary mounts of a) onion peel, and b) human cheek cells, and to record observations and draw their labelled diagrams.
10. To identify parenchyma and sclerenchyma tissues in plants, striped muscle fibres and nerve cells in animals, from prepared slides and to draw their labelled diagrams.
11. To prepare methane gas by heating sodium acetate and soda lime and study its physical properties, i.e. colour, odour, solubility in water and its chemical properties like combustion and action on bromine water and alkaline potassium permanganate solution.
12. To identify the saturated and unsaturated organic compounds out of the following:  
a) Kerosene      b) Vegetable oil      c) Butter      d) Carbon tetrachloride.
13. To test a) the presence of starch in a given food sample, and b) the presence of the adulterant metanil yellow in dal.
14. To study the adaptive features of xerophytes such as cactus, and hydrophytes such as water lily/ lotus. To draw labelled diagrams and record observations.
15. To observe and draw the given specimens earthworm, cockroach, bony fish and bird. For each specimen to record
  - a) one specific feature of its phylum
  - b) one adaptive feature with reference to its habitat.

# CATEGORIES OF PRACTICAL SKILLS

## **A Procedural and Manipulative Skills**

To

- select appropriate apparatus/ instruments for performing the experiment
- know the limitations of the apparatus/ instruments regarding their size, least count and accuracy
- arrange/ assemble/ set and adjust the apparatus systematically
- handle the apparatus, instruments, chemicals carefully to avoid any damage or injury
- perform the experiment with reasonable efficiency and accuracy
- separate and remove desired parts of a specimen for detailed study without damaging it
- use appropriate methods and materials for specimen mounting
- locate and rectify the errors in apparatus, instruments, etc.
- add chemicals in appropriate quantity
- dismantle the experimental set-up carefully
- practise the precautions in handling sensitive apparatus or chemicals or flame

## **B Observational Skills**

To

- find the least count of the instrument
- read the instrument correctly
- notice colour change, evolution of gases, formation of precipitates, chemical reactions, etc carefully
- notice the relevant details in the given specimens minutely
- locate the desired parts in a specimen accurately
- take observations carefully and in a systematic manner
- read graph correctly

## **C Drawing Skills**

To

- make proper observation tables
- draw circuit diagrams, ray diagram, experimental set-up, sketches, etc. correctly and proportionately
- label sketches and diagrams correctly
- draw graphs from observed data correctly

## **D Reporting and Interpretative Skills**

To

- make a proper plan for recording the observations
- record the observations/ data/ information correctly and systematically
- classify and categorize organisms
- make correct calculations/predictions
- use proper formulae and mode of summarising and reporting the result
- report the result using correct symbols, units, terms and chemical equations
- interpret the observations and results correctly

# DESIGN OF THE QUESTION PAPER

## Science and Technology Class IX (Practicals)

Time : 1 ½ hours

Maximum Marks : 20

The weightage of distribution of marks over different dimensions of the question paper shall be as follows

### A UNIT-WISE WEIGTAGE

S. No.	Unit	Relevant experiments in the syllabus	Marks allotted
1.	I Matter Nature and Behaviour	1,2,3	4.5
2.	II Energy (motion, force and work)	4,5,6,7,8	6.5
3.	III Living World (organization in the living world)	9,10,13	5.0
4.	IV Natural Resources	11,12	2
5.	V Our Environment	14,15	2
	<b>TOTAL</b>	<b>15 Experiments</b>	<b>20</b>

### B. SKILL-WISE WEIGHTAGE

Most questions involve multiple skills, and it may not always be possible to precisely assign particular skills to a given question. The skill-wise weightage given in the table below should therefore be considered as only indicative of what is required in the question paper.

Objective	Weightage
Procedural and manipulative skills	35%
Observational skills	35%
Drawing Skills	15%
Reporting and Interpretative Skills	15%
<b>TOTAL</b>	<b>100%</b>

### **C QUESTION-WISE WEIGHTAGE**

All the 30 questions would be of the multiple choice variety having only one correct answer. First 20 questions will carry 0.5 mark each while rest of 10 questions will carry 1 mark each

### **D EXPECTED TIME**

Approximate time for reading and answering one question : 2.5 minutes

Revision time : 15 minutes

### **E DIFFICULTY-WISE WEIGHTAGE**

<b>S. No.</b>	<b>Estimated difficulty level</b>	<b>Percentage</b>
1.	Easy	15
2	Average	70
3	Difficult	15



# Sample Question Paper I

Time: 1 ½ hours

Maximum Marks: 20

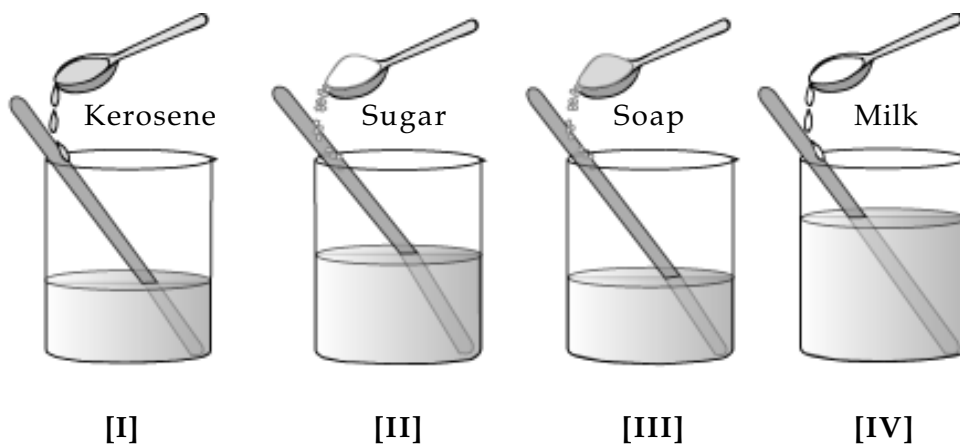
## INSTRUCTIONS :

1. Attempt all questions.
  2. There are 30 multiple choice questions in total. Only one of the options in every question is correct.
  3. The question paper consists of two parts - Part A and Part B. Each of the 20 Questions in part A carries 0.5 mark and each of the 10 questions in part B carries 1.0 mark.
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## SECTION - A

1. The following substances are added to water in a beaker as shown below. The mixture is stirred well. A true solution is found in the beaker

- (a) I
- (b) II
- (c) III
- (d) IV

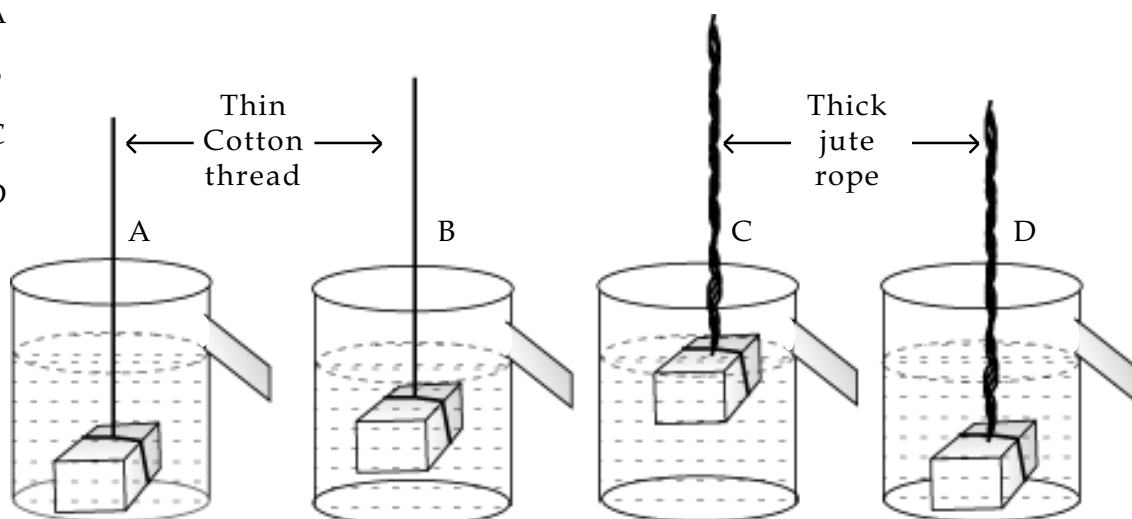


2. When we start heating a mixture of sulphur powder and iron filings, we would observe that
  - (a) sulphur starts melting.
  - (b) iron filings start melting.
  - (c) mixture becomes red hot.
  - (d) mixture evaporates.
3. When magnesium combines with oxygen it produces magnesium oxide that appears to be like
  - (a) wood ash.
  - (b) chalk powder.
  - (c) table salt.
  - (d) powdered sugar.

4. When dilute sulphuric acid is added to zinc granules, you will observe that
- a precipitate is formed.
  - the reaction mixture turns yellow.
  - the container becomes hot.
  - bubbles start coming out from the surface of zinc granules.
5. The correct observation when you mix barium chloride solution with sodium sulphate solution is that
- a white precipitate is formed after some time.
  - a yellow precipitate is formed after some time.
  - a white precipitate is formed instantaneously.
  - a yellow precipitate is formed instantaneously.

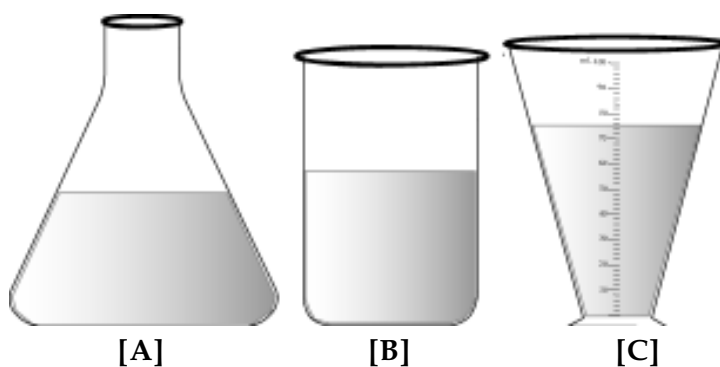
6. In the experiment to establish the relation between loss in weight of an immersed solid with the weight of water displaced by it, the correct setup is shown in figure

- A
- B
- C
- D



7. A given solid is weighed in air using a spring balance. It is then weighed by immersing it fully, in each of the three vessels containing water, as shown. Its weight when immersed, will be

- least in vessel C.
- least in vessel B.
- least in vessel A.
- equal in all the three vessels.



8. A block of wood of mass 100 g is placed on a smooth table in the experimental set up used in the study of limiting friction. A student is asked to choose from the following:

- (i) either pan of mass 30 g or 10 g
- (ii) either slotted discs of mass 10 g each or of 2 g each.

The most suitable combination that she should choose would be

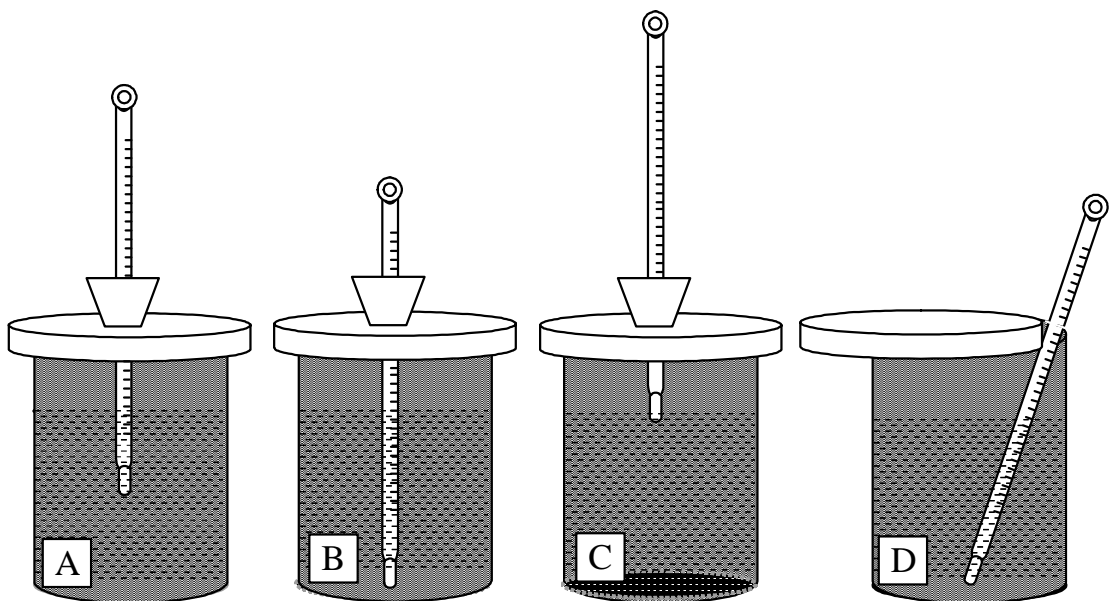
- (a) pan of 30 g and slotted discs of 10 g each.
- (b) pan of 30 g and slotted discs of 2 g each.
- (c) pan of 10 g and slotted discs of 10 g each.
- (d) pan of 10 g and slotted discs of 2 g each.

9. Three students used different kinds of attachments while measuring limiting friction of a block placed over a table. Student A used a rubber band; B used a woollen thread; and C used a cotton thread. The best choice is

- (a) that of A.
- (b) that of B.
- (c) that of C.
- (d) independent of the kind of attachment used.

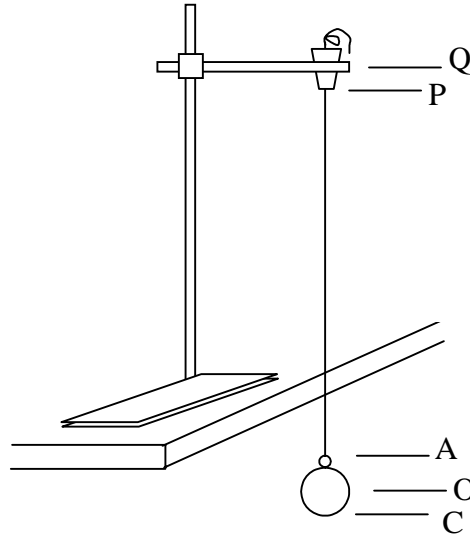
10. The correct arrangement for taking temperature in the study of the temperature-time graph is shown in figure

- (a) A
- (b) B
- (c) C
- (d) D



11. For the simple pendulum shown in the figure, the effective length is

- (a) AP
- (b) OP
- (c) CP
- (d) CQ



12. The initial (A) and final (B) readings on a stop clock for 20 oscillations of a simple pendulum are shown in the figure. The time period of the simple pendulum is

- (a) 2.0 s
- (b) 2.2 s
- (c) 2.5 s
- (d) 5.0 s



13. Nikita observed a slide of human cheek cells under a microscope in its (i) low magnifying power, (ii) high magnifying power settings. In the first setting, she must have observed

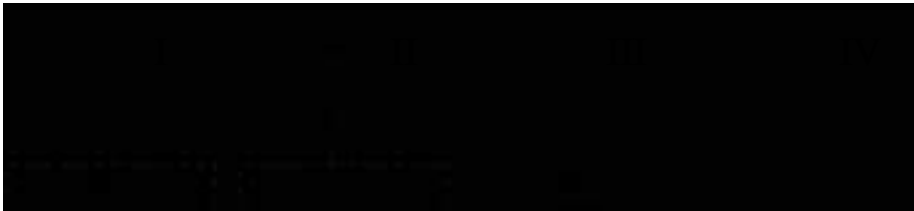
- (a) fewer cells in a darker field of view.
- (b) more cells in a brighter field of view.
- (c) more cells in a darker field of view.
- (d) fewer cells in a brighter field of view.

14. To observe cells in an onion peel, we must prepare the slide by mounting on it

- (a) crushed pulp of onion.
- (b) dry scale leaf.
- (c) green leaf of onion (spring onion)
- (d) thin layer of fleshy leaf of onion.

15. The cellular component NOT seen while observing the slide of an onion peel under a compound microscope is

- (a) chromosomes.
- (b) cell wall.
- (c) nucleus.
- (d) cytoplasm.

16. You are shown two slides of plant tissues: parenchyma and sclerenchyma. You can identify the sclerenchyma by the
- (a) location of nucleus.
  - (b) thickness of cell wall.
  - (c) size of cells.
  - (d) position of vacuoles.
17. Raj observed nerve cells under the microscope, and made the following sketch. The mistake in his drawing is the cyton with
- (a) cilia.
  - (b) dendrites.
  - (c) nucleus.
  - (d) cytoplasm.
18. A student added only two drops of iodine to a rice extract in test tube A. Another student added a little rice extract to iodine solution in test tube B. They would then observe
- (a) a change of colour to blue black in test tube A but not in test tube B.
  - (b) a change of colour to blue black in test tube B but not in test tube A.
  - (c) a change of colour to blue black in both test tubes A and B.
  - (d) no change of colour in any test tube.
19. The proper experimental arrangement to collect methane gas is assembly
- (a) I
  - (b) II
  - (c) III
  - (d) IV
- 
20. Alkaline potassium permanganate solution is used to differentiate between saturated and unsaturated compounds. The container used to store this reagent should be a
- (a) colourless glass bottle.
  - (b) brown coloured bottle.
  - (c) white plastic bottle.
  - (d) sealed aluminium can.

### SECTION - B

21. When an iron nail, rubbed with sand paper, is dipped in copper sulphate solution, we observe that copper gets deposited
- (a) first on the lower part of the nail and proceeds to the upper part.
  - (b) first on the upper part of the nail and proceeds to the lower part.
  - (c) on the entire surface of the nail.
  - (d) on the nail in small patches.

22. When solid lead nitrate is heated in a test tube, what is NOT observed during the reaction is:
- (a) a crackling sound is produced.
  - (b) a brown gas is produced.
  - (c) a light yellow solid is formed.
  - (d) swelling of lead nitrate takes place.
23. The mass of a solid iron cube of side 4 cm is to be determined. Of the four spring balances available, the one best suited for this purpose would have
- (a) range = 0 to 100g, and least count = 1g.
  - (b) range = 0 to 100g, and least count = 5g.
  - (c) range = 0 to 1000g, and least count = 10g.
  - (d) range = 0 to 1000g, and least count = 25g.
24. A student notes down the observations in the two spring balances and the measuring cylinder shown in the figure. From the given observations, the volume of the solid
- (a) is 64 cc
  - (b) is 36 cc
  - (c) is 28 cc
  - (d) 100 cc



25. The table alongside gives the observations reported by two students X and Y for an experiment on the study of temperature-time graph. The experiment is likely to have been performed correctly by

- (a) X.
- (b) Y.
- (c) both X and Y.
- (d) neither X nor Y.

Time (min)	Temp (°C)	
	Student X	Student Y
0	61.0	61.0
2	60.5	59.0
4	60.0	58.0
6	59.0	57.5
8	58.0	57.0
10	56.5	56.5
12	54.0	56.0

26. Four samples of arhar dal (tuvar dal) were taken in four test tubes with some water in each and labelled P, Q, R and S. A few drops of the following were added to these test tubes: water to test tube P, HCl to test tube Q, NaOH to test tube R and alcohol to test tube S. We would be able to confirm adulteration of the dal with metanil yellow in test tubes

- (a) P and Q.
- (b) Q and R.
- (c) R and S.
- (d) S and P.

27. Samples of kerosene, vegetable ghee, groundnut oil and butter are taken in four different test tubes. A few drops of bromine water are added to each of the test tubes. You will observe the decolorisation of bromine water in the case of

- (a) kerosene and butter.
- (b) kerosene and vegetable ghee.
- (c) groundnut oil and butter.
- (d) butter and vegetable ghee.

28. Sana would not believe that the cactus in her garden was a xerophyte. Out of the following,

- A. succulent leaves and deep root system
- B. fleshy stem and spiny leaves
- C. green stem and branched root system
- D. woody stem and spiny leaves

the features of the cactus that show it is a xerophyte are

- (a) A and D.
- (b) B and C.
- (c) A, B and C.
- (d) A, B, C and D.

29. Observe the pictures of honey bee and cockroach. The common feature that assigns them to the same phylum is

- (a) wings.
- (b) three pair of legs.
- (c) jointed appendages.
- (d) antennae.



30. A student found the posterior part of a male cockroach in the laboratory. The following sketch was made. The missing part in the sketch is

- (a) anal cerci.
- (b) anal style.
- (c) brood pouch.
- (d) antennae.





## Scoring Key for Sample Paper I

Q. No.	Key	Explanation
1.	(b)	Sugar makes a true solution.
2.	(a)	Sulphur has a lower melting point than iron.
3.	(a)	Colour and fineness of the powder after complete combustion of wood.
4.	(d)	Reaction occurs at the contact point of the reactants.
5.	(c)	Being an ionic reaction, precipitation is instantaneous.
6.	(b)	The solid must be suspended by an inextensible string in the centre of the overflow can without touching its bottom.
7.	(d)	The loss in weight does not depend upon the shape of the vessel or the volume of water in it.
8.	(d)	A pan of mass 30 g may itself cause a 100 g block to slide on a smooth table. Also, a better least count is always desirable.
9.	(c)	We need an inextensible string.
10.	(a)	The thermometer must be dipped vertically in the water level away from the bottom and sides of the calorimeter and close to the middle of the water level.
11.	(b)	The length of the pendulum equals the length from the bottom of the suspension to the centre of the bob.
12.	(c)	The zero error of 5 seconds has to be added to the observed reading here.
13.	(b)	Lower the magnifying power, more is the number of cells seen. (in a brighter field.)
14.	(d)	To observe a living plant cell with a distinct Nucleus, this is the best material
15.	(a)	Chromosomes are not seen in interphase cells.
16.	(b)	Parenchyma is thin walled, sclerenchyma is thick walled.
17.	(a)	No cilia in cyton.
18.	(c)	Iodine + Starch solution -----> Blue black colour.
19.	(a)	Methane is insoluble in water.
20.	(b)	Sensitive to light.
21.	(c)	Iron nail was rubbed before doing the experiment to expose the entire surface
22.	(d)	Lead Nitrate decomposes into Brown $\text{NO}_2$ gas and yellow Pbo on heating.

23.	(c)	We must have a smaller least count. We must have a rough estimate of the measurement to be taken to select the range.
24.	(c)	The volume of the solid (in cc) has the same magnitude as its loss in weight (in grams) in water.
25.	(b)	The rate of fall of temperature is faster first and slower later.
26.	(a)	Metanil yellow is soluble in water and becomes pink with HCl.
27.	(c)	Unstaturated compounds decolourise Bromine water.
28.	(c)	Paucity of water; hence long roots, fleshy stem.
29.	(c)	All arthropods have jointed appendages.
30.	(b)	Only male cockroaches have anal styles along with anal styles.

## Questionwise Analysis for Sample Paper I

Q. No.	Unit name	Expt. No.	Skill Tested
1.	Unit I	1	R
2.	Unit I	2	O
3.	Unit I	3	O
4.	Unit I	3	O, R
5.	Unit I	3	O, R
6.	Unit II	4	M
7.	Unit II	5	O, R
8.	Unit II	6	P
9.	Unit II	6	M
10.	Unit II	7	M
11.	Unit II	8	P, D
12.	Unit II	8	O, D, R
13.	Unit III	9	O, R
14.	Unit III	9	P, M
15.	Unit III	9	O
16.	Unit III	10	O
17.	Unit III	10	D
18.	Unit III	13	O, R
19.	Unit IV	11	M
20.	Unit IV	12	P, O
21.	Unit I	3	O
22.	Unit I	3	O
23.	Unit II	4	M
24.	Unit II	5	O, R
25.	Unit II	7	O, R
26.	Unit III	13	P
27.	Unit IV	12	O, R
28.	Unit V	14	O, R
29.	Unit V	15	O, D, R
30.	Unit V	15	O, D

P: Procedural skills; M: Manipulative skills; O: Observational skills;  
D: Drawing skills; R: Reporting and interpretative skills

# Sample Question Paper II

Time : 1 ½ hours

Maximum Marks : 20

## INSTRUCTIONS :

1. Attempt all questions.
2. There are 30 multiple choice questions in total. Only one of the options in every question is correct.
3. The question paper consists of two parts - Part A and Part B. Each of the 20 Questions in part A carries 0.5 mark and each of the 10 questions in part B carries 1.0 mark.

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### SECTION - A

1. A student was asked to mix the white of an egg with water and stir well. The student observed that
  - (a) a transparent solution is formed.
  - (b) a translucent mixture is formed.
  - (c) egg white settles down at the bottom.
  - (d) egg white floats on the surface of the water.
2. We want to carry out a reaction of zinc granules with sulphuric acid. One bottle contains concentrated sulphuric acid and another bottle contains dilute sulphuric acid. The correct way of carrying out the reaction is to
  - (a) use concentrated sulphuric acid.
  - (b) add water to concentrated sulphuric acid before using it.
  - (c) use dilute sulphuric acid.
  - (d) mix concentrated and dilute sulphuric acid and add water to it.
3. To prepare iron sulphide, by heating a mixture of iron filings and sulphur powder, we should use a
  - (a) copper dish.
  - (b) watch glass.
  - (c) china dish.
  - (d) petri dish.
4. We will observe a precipitation to occur in the solution used when
  - (a) barium chloride is added to sodium sulphate.
  - (b) barium chloride is added to sodium chloride.
  - (c) sodium sulphate is added to sodium chloride.
  - (d) hydrochloric acid is added to barium chloride.

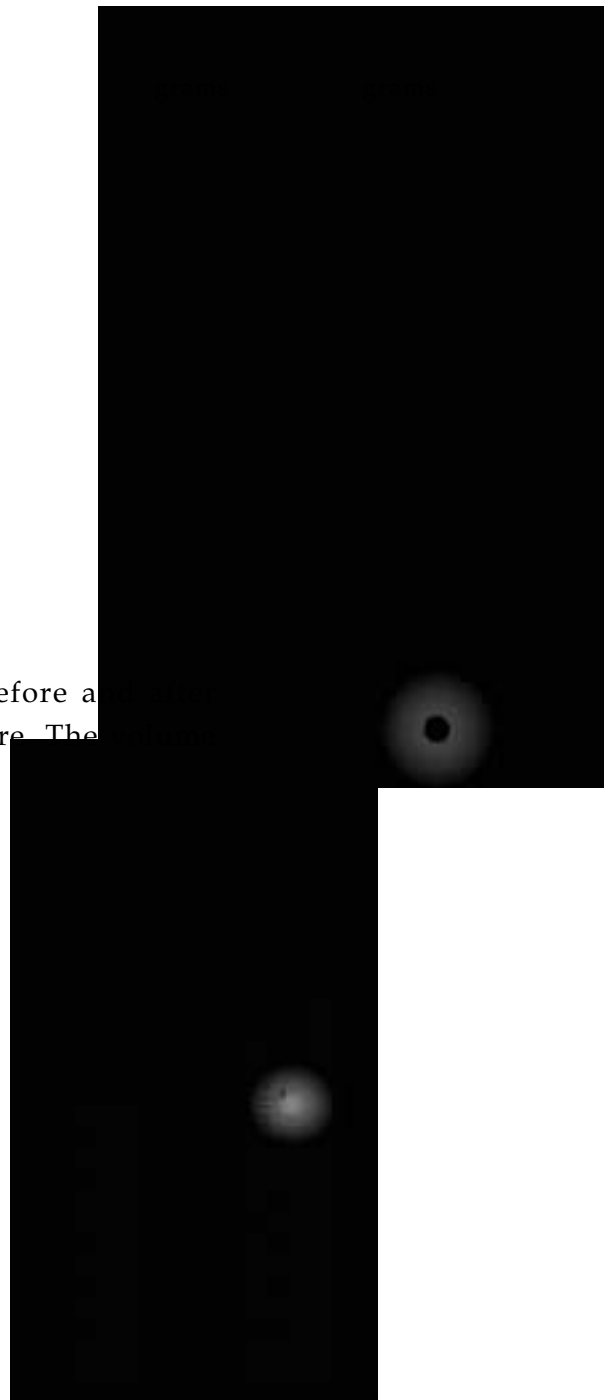
(20)

5. A student by mistake mixed iron filings and sulphur powder. He wanted to separate them from each other. The method you would advise him to use is to dissolve the mixture in
- (a) boiling water.
  - (b) cold water.
  - (c) carbon disulfide.
  - (d) kerosene.

6. The spring balance shown here is used to measure the mass of a given solid. The mass of the solid is
- (a) 115 g
  - (b) 118 g
  - (c) 120 g
  - (d) 125 g

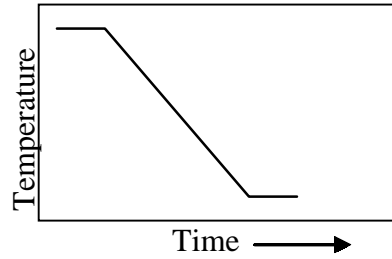
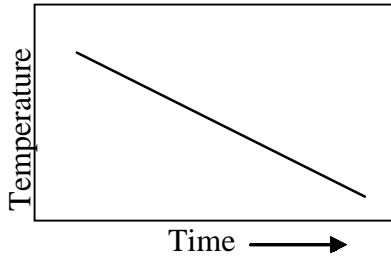
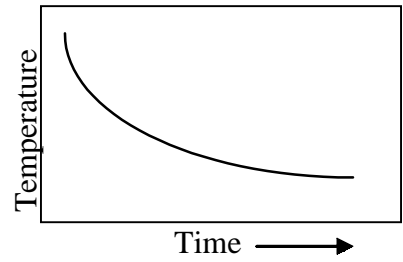
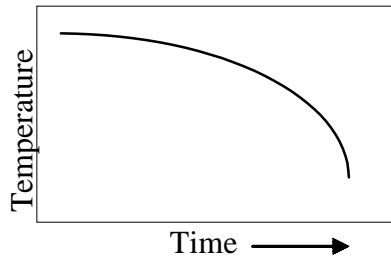
7. The water level in a measuring cylinder, before immersing a solid in it, is shown in the figure. The volume of the given solid in, cc, is

- (a) 1.8
- (b) 2.0
- (c) 2.2
- (d) 2.4



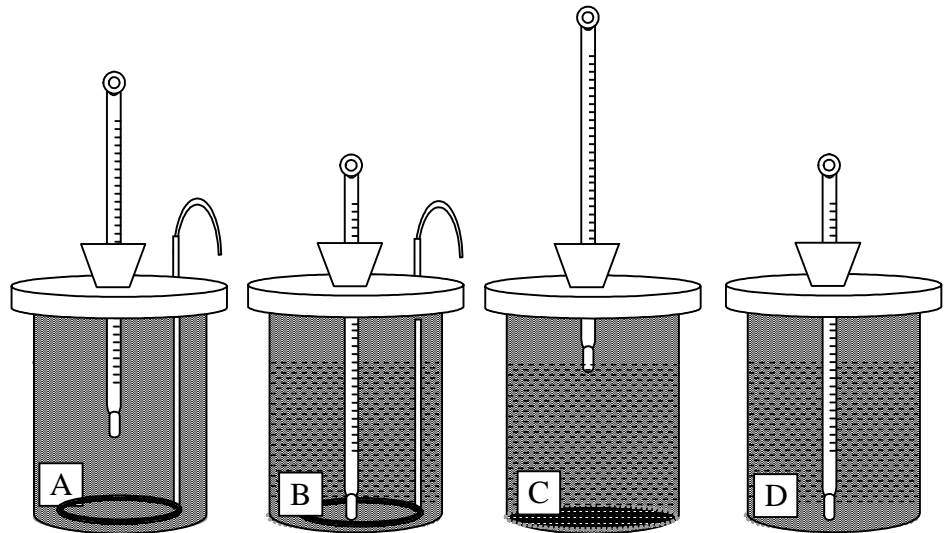
8. The temperature-time graph obtained when a hot liquid is allowed to cool, is likely to resemble graph

- (a) A
- (b) B
- (c) C
- (d) D



9. Of the four experimental set-ups shown here to study temperature-time graph, the best one is

- (a) A
- (b) B
- (c) C
- (d) D



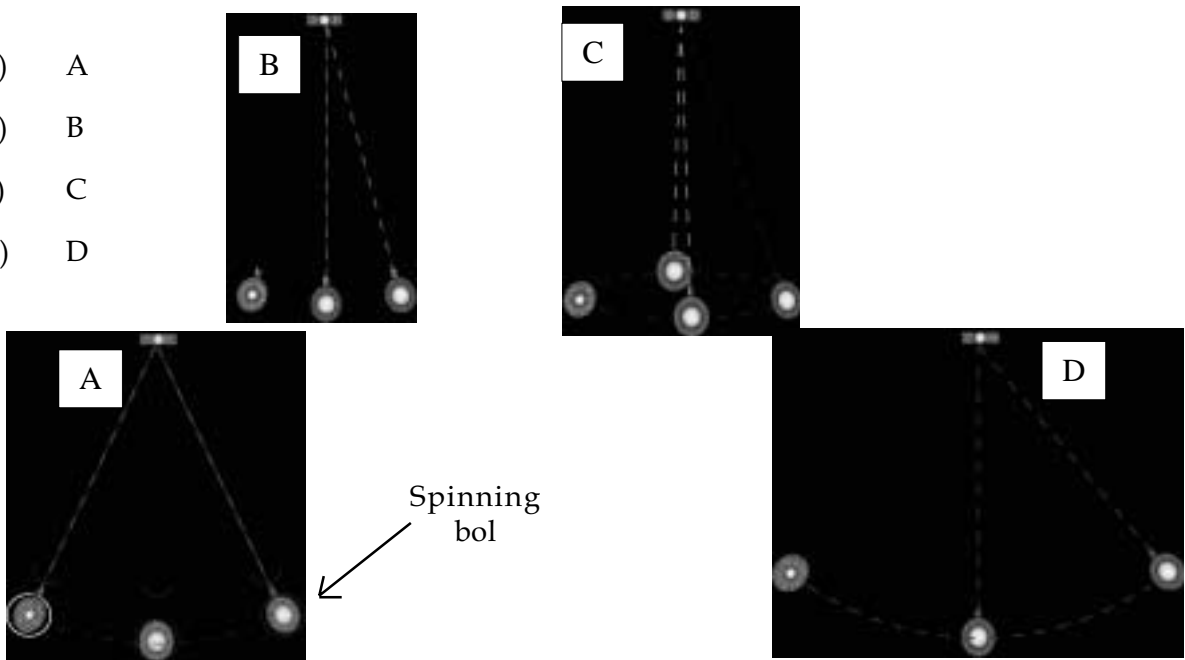
10. Student A counts the number of oscillations of a pendulum by counting the number of times it passes the mean position. Student B counts the number of times it reaches the extreme position on the right. Both calculate the time per oscillation ( $T$ ) by dividing the total time by the number of oscillations counted. The value of  $T$  obtained by

- (a) student A will be correct.
- (b) student B will be correct.
- (c) both students A and B will be correct.
- (d) neither student A nor student B will be correct.

11. For determining the time period of a simple pendulum, the bob should be suspended by means of a
- fine cotton thread.
  - thin copper wire.
  - thin elastic string.
  - woollen thread.

12. Out of the following, the best choice for measuring the time period of a simple pendulum is

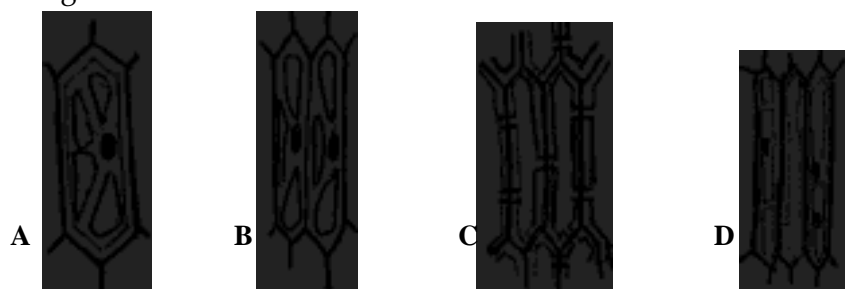
- A
- B
- C
- D



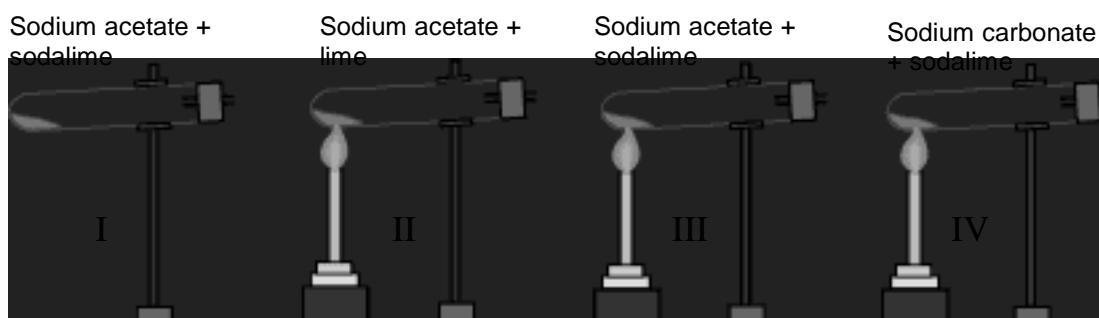
13. Trupti was observing an onion peel stained with safranin under a microscope. The colour of the cell wall appeared
- deep blue.
  - black.
  - pinkish red.
  - yellow.

14. While observing a thin section of a plant stem, four students sketched sclerenchyma as given below. The correct diagram is

- A
- B
- C
- D



15. On the laboratory table were placed four watch glasses with labels A, B, C and D. Watch glass "A" had chalk powder, "B" had sago powder, "C" had common salt and "D" had powdered sugar. On adding two drops of iodine to the content of each watch glass, the one turning blue black will be
- A
  - B
  - C
  - D
16. Seema bought arhar dal (tuar dal) from the market. On adding water to the dal the water became yellow in colour. She took a sample of this yellow water to the laboratory and added a few drops of HCl. The sample became pink. This confirmed that the adulterant added to the dal was
- turmeric.
  - metanil yellow.
  - potassium dichromate.
  - yellow dye.
17. To observe starch granules in potato under a microscope, freshly cut surface of potato was pressed on a slide. The stain that will show starch granules clearly is
- methylene blue.
  - iodine.
  - safranin.
  - eosin.
18. When asked to prepare methane gas in the laboratory, four groups of students had set up apparatus as shown in I, II, III and IV. Only one group of students succeeded in getting the gas. This group was the one with
- set-up I.
  - set-up II.
  - set-up III.
  - set-up IV.





19. Most of the organic compounds are flammable in nature. The correct safety, symbol that is normally labelled on the bottles of such compounds is shown in figure.

- (a) I
- (b) II
- (c) III
- (d) IV



20. Noor wants to observe a spiracle of a cockroach. She should observe the region on its body shown by the label

- (a) A
- (b) B
- (c) C
- (d) D



### SECTION - B

21. Four students were asked to observe the effect of heat on lead nitrate crystals. The teacher provided them with test tube holders, test tubes and solid lead nitrate. The students then started heating lead nitrate as shown below. The teacher stopped three of them for using a wrong procedure. The correct way of heating is shown in setup

- (a) I
- (b) II
- (c) III
- (d) IV



I

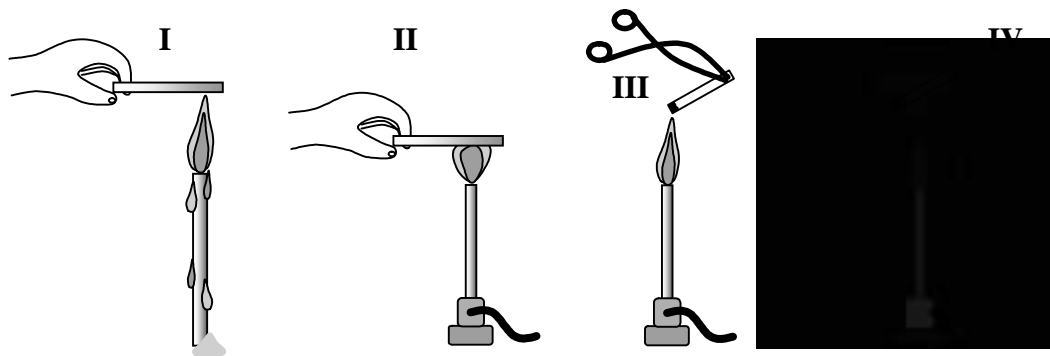


III



22. Four students used different ways of burning magnesium ribbon during an experiment as shown below. The correct way has been followed by student

- (a) I
- (b) II
- (c) III
- (d) IV



23. You are given solid cubes of aluminium and iron, each of side 4cm, and two spring balances. Balance A has a range of 0 to 250 g and a least count of 2.5 g, while balance B has a range of 0 to 1000 g and a least count of 10 g. The preferred option for mass measurement would be to use

- (a) balance A for both the cubes.
- (b) balance B for both the cubes.
- (c) balance A for the aluminium cube and balance B for iron cube.
- (d) balance A for the iron cube and balance B for aluminium cube.

24. The readings of the spring balance will be

- (a) equal to each other in all cases A, B and C.
- (b) equal to each other in cases A and C only.
- (c) equal to each other in cases B and C only.
- (d) different in every case.



25. A student observes that a block kept on a table, in the experimental set up used in the study of limiting friction, begins to move after adding 5g to the pan. The mass of the pan is 25g. If an identical block of the same mass is kept on the first block, the additional mass to be put in the pan, needed to just move the blocks, would most likely be
- 10 g
  - 20 g
  - 30 g
  - 40 g

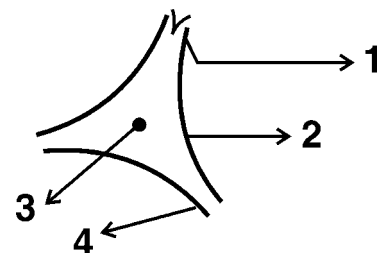
26. Given below are four operations for preparing a temporary mount of human cheek cells:
- taking scraping from inner side of the cheek and spreading it on a clean slide
  - putting a drop of glycerine on the material
  - adding two or three drops of methylene blue
  - rinsing the mouth with fresh water and disinfectant solution.

The correct sequence of these operations is

- i-ii-iii-iv
  - iv-i-iii-ii
  - iv-i-ii-iii
  - i-iii-ii-iv
27. You are viewing a prepared slide of striped muscle fibres from cockroach leg. When you focus the microscope, the striations appear pale and indistinct. To make the striations clearly visible, you would
- slowly close the diaphragm to reduce the light.
  - remove the mirror to cut out light.
  - change the eye piece to increase magnification.
  - replace the objective to decrease magnification.

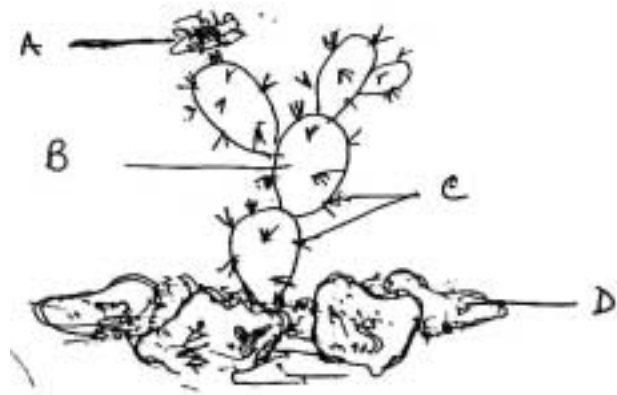
28. A figure depicting parts of a neuron is given below. The correct identification of the labels 1, 2, 3, 4 respectively is

- dendrite, cytoplasm, nissl granules, nerve fibre.
- cilia, endoplasmic reticulum, nucleoli, nerve fibre.
- dendrons, cell body, Nissl granuale, axon.
- dendrites, cyton, nucleus, axon.



29. Samples of a few fats and oils were stored in the laboratory for performing experiments. One of the containers did not have any label. When tested, it was found that the unknown sample did not decolorize alkaline potassium permanganate solution. The sample could be
- vanaspati ghee.
  - mustard oil.
  - linseed oil.
  - castor oil.
30. The part that prevents loss of water and the part that stores water, in the plant shown in this drawing are

- A and D
- B and A
- C and B
- D and C



## Scoring Key for Sample Paper II

Q. No.	Key	Explanation
1.	(b)	Egg white forms colloids.
2.	(c)	Adding water to conc $H_2SO_4$ is not advisable
3.	(c)	To avoid side reaction and breakage at high temperature
4.	(a)	Barium sulphate precipitate is white
5.	(c)	Sulphur is soluble in carbon disulphide.
6.	(a)	The zero error has to be correctly accounted for
7.	(c)	The correct reading of the lower meniscus has to be taken in both the cases
8.	(b)	The liquid cools faster first and slowly later on
9.	(a)	We need a stirrer and a thermometer correctly positioned without touching the sides of the calorimeter
10.	(b)	Student A will count twice the number of actual oscillations.
11.	(a)	We must use an inextensible string in a simple pendulum
12.	(b)	The pendulum bob must be made to swing with a small amplitude without spinning or moving in a circular path
13.	(c)	Safranin stains cellulose.
14.	(c)	Pits, non nucleated cells, thick cell walls characteristics.
15.	(b)	Sago contains starch.
16.	(b)	Metanil yellow (aq)+HCl = Pink
17.	(b)	Test for starch.
18.	(c)	Correct combination of chemicals and heating is essential.
19.	(d)	To indicate that organic compounds are flammable
20.	(c)	Correct location of spiracles.
21.	(b)	Tip of the flame hottest. Holder should hold test tube at the top and face should be away.
22.	(c)	Pair of tongs necessary.
23.	(c)	While preferring a smaller least count, we should estimate the range needed for a given measurement and select accordingly.
24.	(c)	The loss in weight of a fully immersed solid does not depend on the shape of the vessel or the volume of water in it
25.	(c)	We need to double the total mass of the pan and its weight to move a block of double the mass. That is, we need 35g in the pan. So additional mass to be put is 30g.
26.	(b)	Mouth to be disinfected first and glycerine to be added last.
27.	(a)	Reduction of light gives a better contrast.
28.	(d)	Correct labelling.
29.	(a)	Vanaspati ghee is the only saturated substance.
30.	(c)	Organisms-habitat correlation. Leaves modified into spine to reduce less water from the plant body and the fleshy stem stores water.

## Questionwise Analysis for Sample Paper II

Q. No.	Unit name	Expt. No.	Skill Tested
1.	Unit I	1	O
2.	Unit I	3	P, M
3.	Unit I	2	M
4.	Unit I	3	O, R
5.	Unit I	2	P
6.	Unit II	4	O, R
7.	Unit II	5	O, D
8.	Unit II	7	O, D
9.	Unit II	7	M
10.	Unit II	8	P
11.	Unit II	8	P
12.	Unit II	8	P,M,O
13.	Unit III	9	O
14.	Unit III	10	D
15.	Unit III	13	O, R
16.	Unit III	13	O, R
17.	Unit IV	13	O, R
18.	Unit IV	11	M
19.	Unit IV	11	R
20.	Unit IV	15	D
21.	Unit IV	11, 12	M
22.	Unit II	3	M, D
23.	Unit II	4	P
24.	Unit II	5	O
25.	Unit II	6	O, R
26.	Unit III	9	P
27.	Unit III	10	M
28.	Unit III	10	D, R
29.	Unit IV	12	R
30.	Unit V	14	O, D

P: Procedural skills; M: Manipulative skills; O: Observational skills;  
D: Drawing skills; R: Reporting and interpretative skills

# Sample Question Paper III

Time : 1 ½ hours

Maximum Marks : 20

## INSTRUCTIONS :

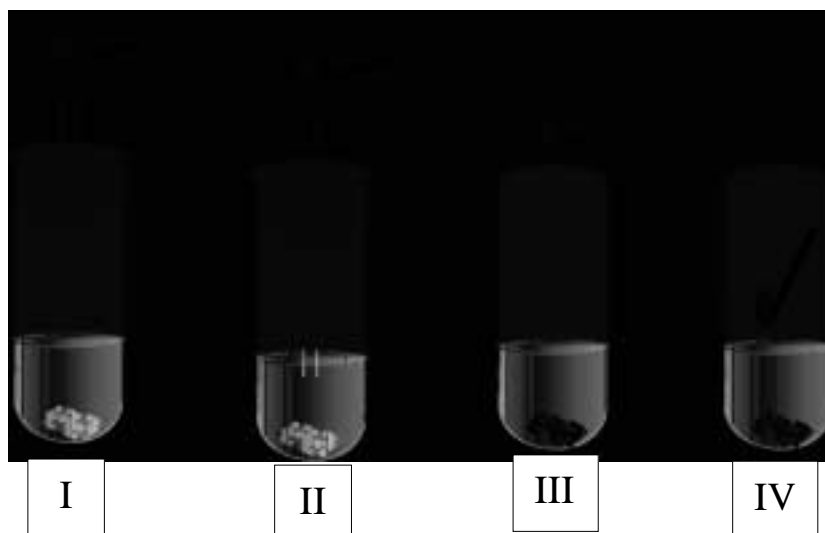
1. Attempt all questions.
2. There are 30 multiple choice questions in all. Only one of the options in every question is correct.
3. The question paper consists of two parts - Part A and Part B. Each of the 20 Questions in part A carries 0.5 mark and each of the 10 questions in part B carries 1.0 mark.

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### SECTION - A

1. You have prepared four different mixtures in water using 1. charcoal powder, 2. chalk powder, 3. slaked lime and 4. detergent powder. If you filter these mixtures through a filter paper, there will be no residue left after filtration in the case of
  - (a) charcoal powder.
  - (b) chalk powder.
  - (c) slaked lime.
  - (d) detergent powder.
2. The safest method to detect hydrogen gas produced in a reaction would be the method shown in

- (a) I
- (b) II
- (c) III
- (d) IV



3. To prepare a colloidal solution of starch we should
  - (a) add starch powder to boiling water and cool.
  - (b) add starch powder to cold water and boil.
  - (c) heat starch powder, add it to cold water and then bring to boil.
  - (d) add a thin paste of starch to boiling water while stirring.

4. Students were asked to study the reaction between barium chloride and sodium sulphate. Four different reports of the experiment are given below. Choose the correct one.

	Procedure	Observation
(a)	Mixed powder of barium chloride and sodium sulphate.	The colour of mixture changes to yellow.
(b)	Mixed solutions of barium chloride and sodium sulphate.	Thick white precipitate is formed.
(c)	Added solution of barium chloride to sodium sulphate powder.	Solution becomes turbid.
(d)	Added powder of barium chloride to sodium sulphate solution.	No change is observed.

5. 100 mL of saturated copper sulphate solution was taken in a beaker. A small amount of iron filings was added to the beaker and left undisturbed overnight. The mixture was then filtered to obtain the residue. The colour of the residue was found to be

- (a) greenish blue.
- (b) faint green.
- (c) steel grey.
- (d) reddish brown.

6. The correct way of reading the liquid level is shown in

- (a) figure A.
- (b) figure B.
- (c) figure C.
- (d) figure D.

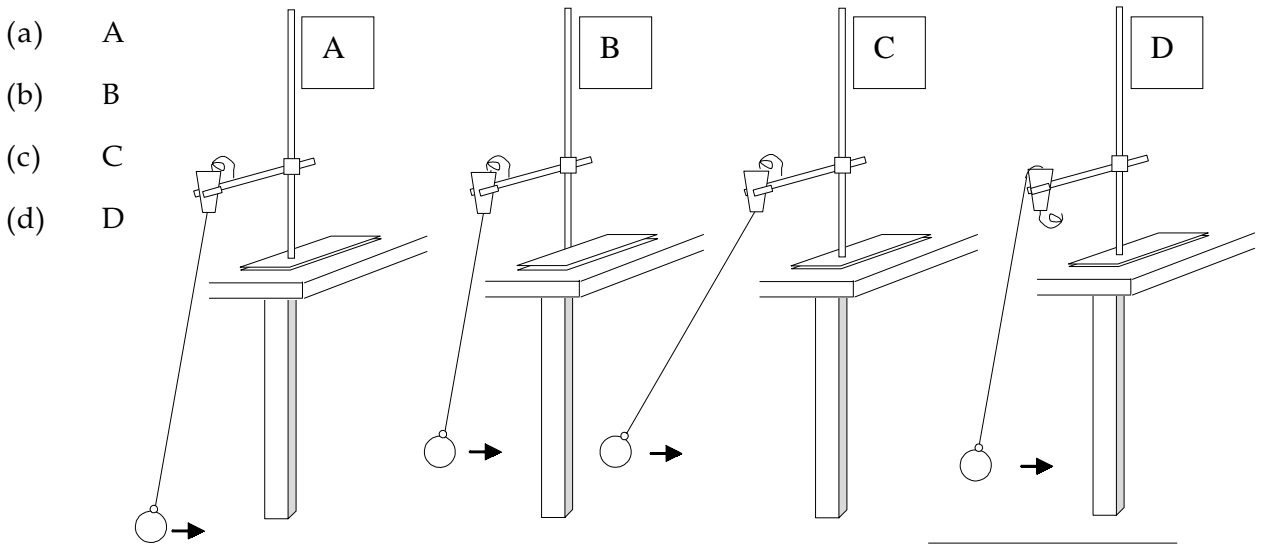




7. While determining the density of a copper piece using a spring balance and a measuring cylinder, Seema carried out the following procedure:
- noted the water level in the measuring cylinder without the copper piece
  - immersed the copper piece in the water
  - noted the water level in the measuring cylinder with the copper piece inside it
  - removed the copper piece from the water and immediately weighed it using a spring balance.

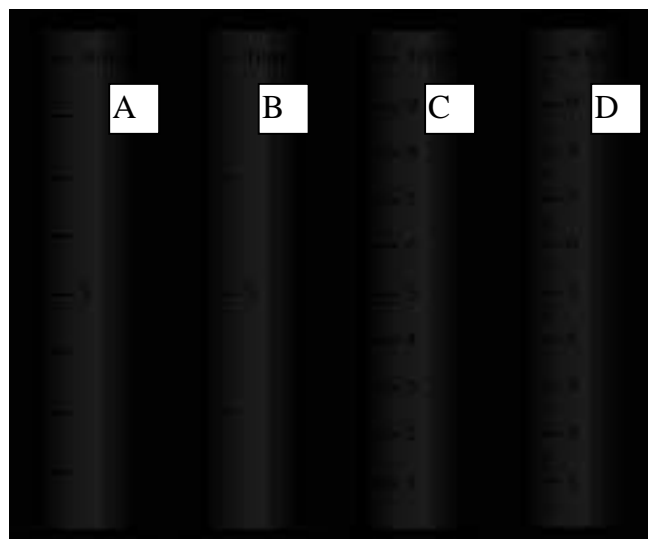
The wrong step in the procedure is

- step (i).
  - step (ii).
  - step (iii).
  - step (iv).
8. The correct experimental set-up for studying the variation of time period with length of a simple pendulum is shown in figure



9. Four measuring cylinders with different least counts are shown in figures A, B, C and D. The most suitable cylinder for determining the volume of a cube of side nearly 1cm is

- A
- B
- C
- D



10. The correct experimental setup for determining the mass of a solid in water is shown in figure

- (a) A
- (b) B
- (c) C
- (d) D



11. Three students made their simple pendulums as follows:

Student A used an **iron bob** and a **woollen thread**

Student B used an **iron bob** and a **cotton thread**

Student C used a **wooden ball** and a **cotton thread**

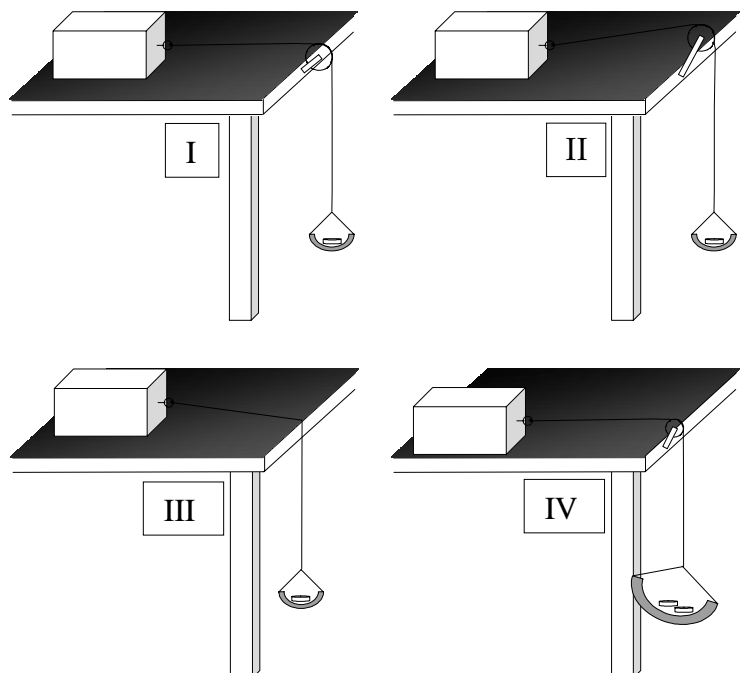
Student D used a **wooden ball** and a **woollen thread**.

The best choice is that of student

- (a) A.
- (b) B.
- (c) C.
- (d) D.

12. The correct experimental set-up for studying limiting friction is shown in figure

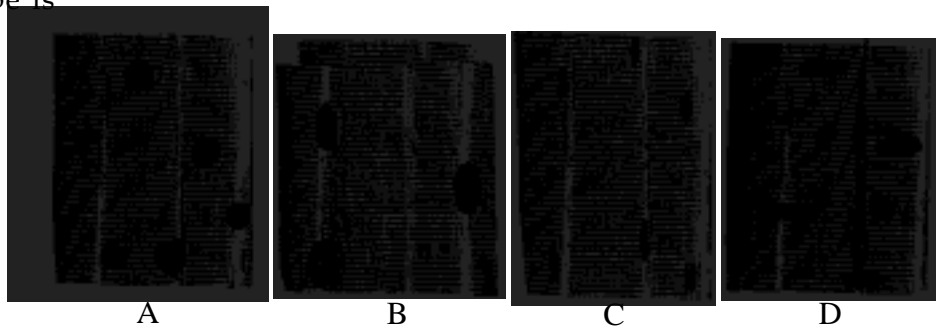
- (a) I
- (b) II
- (c) III
- (d) IV



13. Human cheek cells stained in methylene blue and mounted in glycerine were observed with the help of a compound microscope. The components of the cell which would be seen are
- cell wall, cytoplasm, nucleus.
  - plasma membrane, cytoplasm, nucleus.
  - plasma membrane, cytoplasm, nucleus, mitochondria.
  - plasma membrane, cytoplasm, nucleus, mitochondria, golgi, lysosomes.

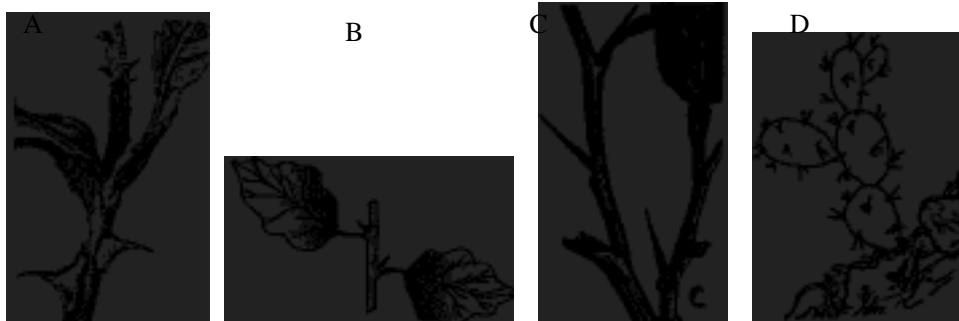
14. Observe the location and shape of the nuclei in the four drawings of the striated muscle fibres given below. The drawing that most resembles the slide of striated muscle fibre under the microscope is

- A
- B
- C
- D



15. After preparing methane gas in the laboratory you must have tested that it burns in air. It is similar in appearance to the burning of
- coal.
  - a candle.
  - magnesium.
  - cooking gas.
16. Bromine water, an important chemical reagent, is stored in a stoppered
- colourless glass bottle.
  - amber coloured bottle.
  - tin container.
  - aluminium container.

17. Sameer observed stems of four plants in a nursery. They are sketched as A, B, C, D below:



Of these the stem of the plant which conserves water is

- (a) A
- (b) B
- (c) C
- (d) D

18. Here are the pictures of cactus and lotus. You have observed their stems in the laboratory.



The correct statement regarding the interior of the stems of these plants is:

- (a) The stem of lotus has no empty space inside.
- (b) The stem of cactus is full of empty tubes.
- (c) The interior of cactus stem is dry.
- (d) The stem of lotus is hollow.

19. Observe the pictures of a bird and a bony fish.

The feature that places them in the same phylum is

- (a) pointed heads.
- (b) bulky thorax.
- (c) presence of scales.
- (d) post anal tails.



20. An unlabelled outline diagram of an earthworm is drawn below.

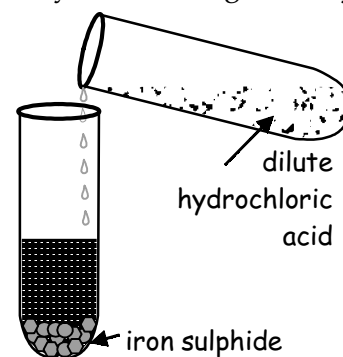
The important feature to be drawn and labelled for placing the earthworm in its phylum is

- (a) eye.
- (b) clitellum.
- (c) annuli.
- (d) anus.



## SECTION - B

21. Take dilute sulphuric acid in a test tube and put a few zinc granules into the test tube. You would observe that
- zinc granules change to powder.
  - colour of zinc changes from grey to white.
  - the size of the zinc granules keeps decreasing.
  - the surface of zinc metal becomes bright.
22. In the experiment shown a gas is evolved. Four groups of students have recorded their observations on the gas produced as shown in the following table. Choose the correct set of observations. Note that the positive responses are shown by '✓' and negative by 'X' signs respectively.



	Colour of the gas	Odour of the gas	Flammability	Action on lead acetate paper
(a)	X	✓	✓	X
(b)	X	✓	X	✓
(c)	✓	✓	X	✓
(d)	X	X	✓	X

23. In a simple pendulum experiment, students A, B and C varied the effective lengths of their pendulums as per the sequence shown in the table. The sequence followed by

- students A and C are better than that of student B.
- students A and B are better than that of student C.
- students B and C are better than that of student A.
- students A, B and C are all equally good.

S.No.	A	B	C
1	120 cm	100 cm	65 cm
2	110 cm	120 cm	75 cm
3	100 cm	70 cm	85 cm
4	90 cm	110 cm	95 cm
5	80 cm	80 cm	105 cm
6	70 cm	90 cm	115 cm

24. Three students A, B and C determined the volume of a solid by immersing it in water in the overflow cans set up as shown. The result obtained will be wrong for

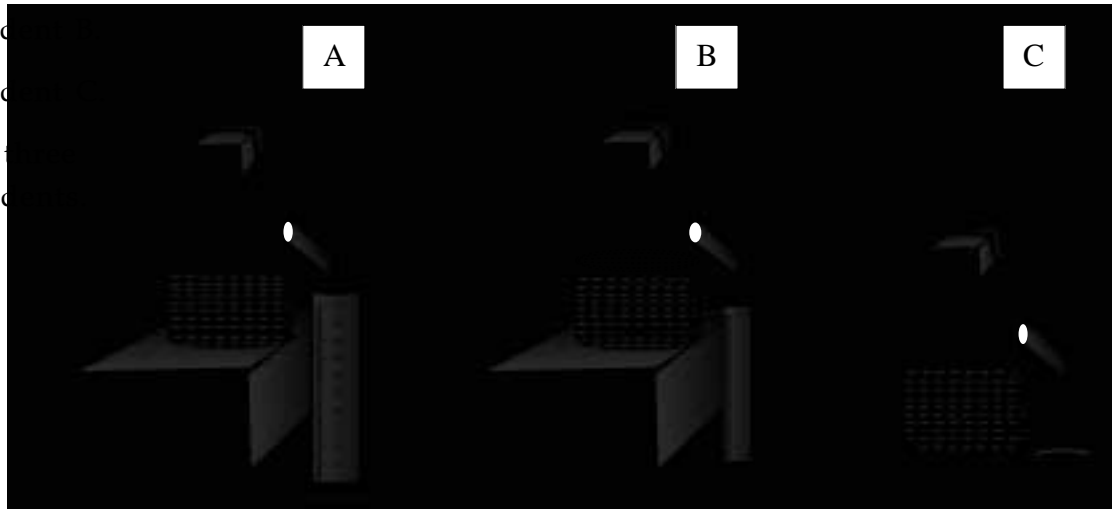
(a) student A.

(b) student B.

(c) student C.

(d) all the students.

stud



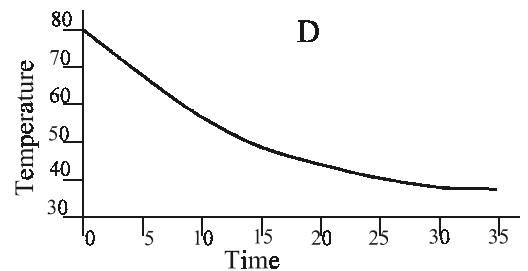
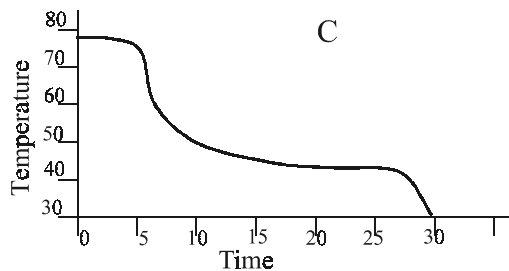
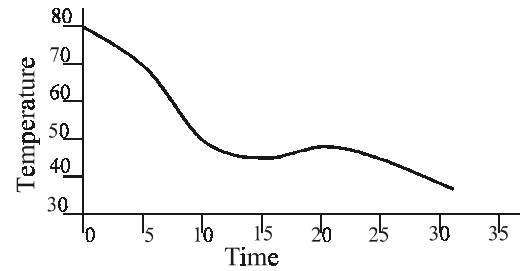
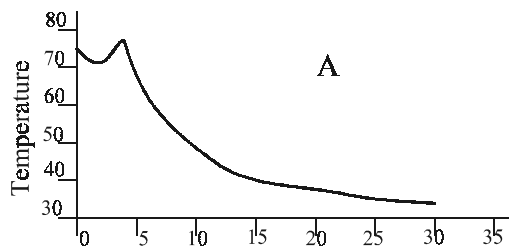
25. The temperature-time variation graphs, as obtained by four students A, B, C and D are as shown. The graph, likely to be correct is that of student

(a) A

(b) B

(c) C

(d) D



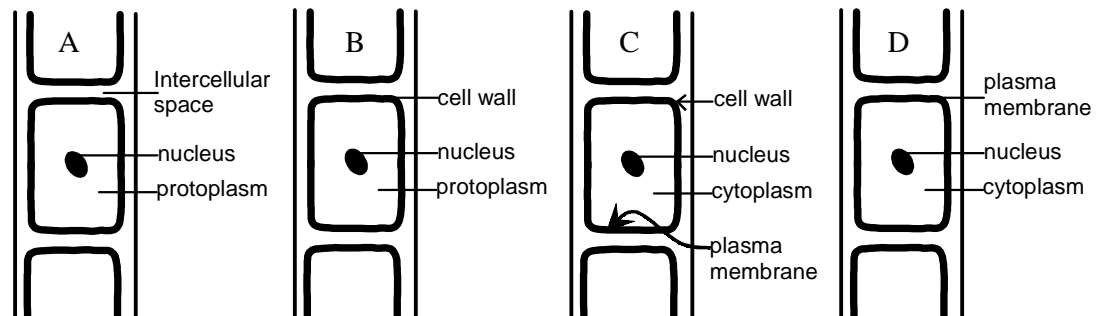
26. Diagrams of cells of an onion peel were labelled by four students as given below. The correctly labelled diagram is

(a) A

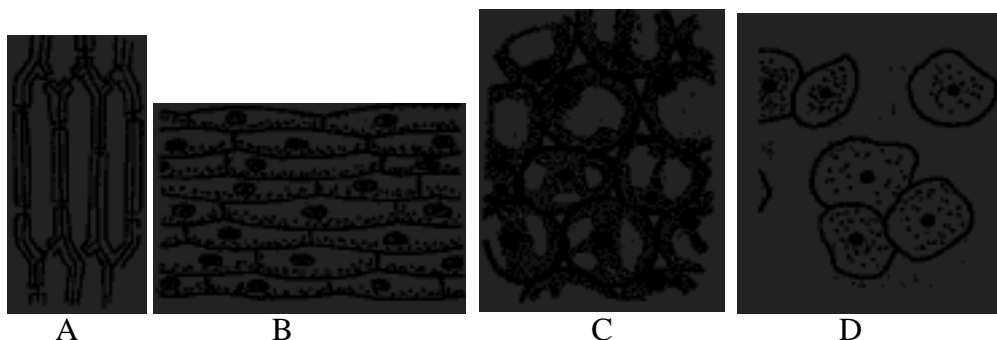
(b) B

(c) C

(d) D



27. Four slides were observed under the microscope for spot test as shown below. The correct identification of the four spots is



(a)	A: onion peel	B: cheek cells	C: sclerenchyma	D: parenchyma
(b)	A: cheek cells	B: parenchyma	C: sclerenchyma	D: onion peel
(c)	A: parenchyma	B: cheek cells	C: onion peel	D: sclerenchyma
(d)	A: sclerenchyma	B: onion peel	C: parenchyma	D: cheek cells

28. Paul was rushing with a bottle of tincture iodine. Some iodine solution splashed on his yellow coloured cotton shirt and also on the white table cloth. The stain on the table cloth was yellowish brown while that on his shirt was blue black. The most plausible scientific reason for this is that the
- shirt was dyed with metanil yellow.
  - shirt was starched after washing.
  - table cloth was starched but not the shirt.
  - shirt had absorbed sweat.
29. The teacher asked the students to correctly record results of the experiment done to detect presence of metanil yellow in the adulterated arhar dal (tuvar dal) sample that was provided to them.

	<b>Procedure</b>	<b>Observation</b>	<b>Inference</b>
A	5 g dal + 5 g metanil yellow	dal turns yellow	metanil yellow present
B	5 g dal + 5 mL water + 2 drops of HCl	solution turns pink	metanil yellow present in the sample
C	5 g dal + 5 mL water + pinch of metanil yellow	water turns yellow	metanil yellow present
D	5 g dal + 5 mL water 2 drops of HCl	metanil yellow present	water turns yellow and then + pink

The correct recording of the experiment is done in table

- (a) A
- (b) B
- (c) C
- (d) D

30. For collecting methane gas prepared in the laboratory, four students followed different procedures. The correct procedure was

- (a) gas jar half-filled with water was inverted on the beehive shelf.
- (b) gas jar completely filled with water was inverted on the beehive shelf.
- (c) an empty gas jar was inverted on the beehive shelf.
- (d) an empty gas jar was placed with its bottom touching the beehive shelf.



## Scoring Key for Sample Paper III

Q. No.	Key	Explanation
1.	(d)	Detergents form colloidal solution in water.
2.	(a)	Delivery tube should not touch the liquid.
3.	(d)	Thin paste of starch enables colloidal formation.
4.	(b)	Rate of reaction is faster in solutions, BaSO <sub>4</sub> is white.
5.	(d)	Copper formed, having reddish brown colour.
6.	(a)	We need to position the eye in level with the lower part of the concave meniscus. Measuring cylinder must be placed on a flat surface.
7.	(d)	It is wrong to weigh a wet copper piece in air.
8.	(b)	The bob has to be suspended in the correct way and must oscillate with small amplitude without touching the table and the floor.
9.	(d)	The least count of the measuring cylinder must not be of the same order or larger than the volume to be measured.
10.	(b)	The solid must be fully immersed without touching the bottom. Also, no part of the spring balance must dip into water.
11.	(b)	It is important to use an inextensible string and it is preferable to use a small compact bob.
12.	(a)	The string attached to the mass on the table must run parallel to the table surface and pass over a smooth pulley. The motion of the pan with weights must not be stopped by leg of table.
13.	(b)	The only components of the cell seen under a compound microscope.
14.	(c)	Nuclei at periphery.
15.	(d)	Both methane and cooking gas burn with a blue flame.
16.	(b)	Bromine is photosensitive and oxidizing.
17.	(d)	Feature of xerophyte
18.	(d)	Comparison of features of hydrophyte and xerophyte
19.	(d)	Chordate characteristics
20.	(c)	Annuli feature of phylum annalida
21.	(c)	Zinc is consumed during the reaction.
22.	(b)	H <sub>2</sub> S gas produced affects lead acetate paper.
23.	(a)	It is always a better experimental practice to take observations in a systematic sequential manner.

24.	(d)	The overflow can must always be filled up to its spout before using it to measure the volume displaced by the immersed solid.
25.	(d)	The liquid cools faster first and slowly later on when its temperature gets close to the surrounding temperature.
26.	(c)	Correct labelling.
27.	(d)	Correct identification of 4 tissue.
28.	(b)	Starch test.
29.	(b)	Aq metanil + Hcl -----> Pink colour
30.	(b)	Methane gas is lighter than water and also insoluble in water.

## Questionwise Analysis for Sample Paper III

Q. No.	Unit name	Expt. No.	Skill Tested
1.	Unit I	1	O, R
2.	Unit I	3	M
3.	Unit I	1	M
4.	Unit I	3	O, R
5.	Unit I	3	O
6.	Unit II	4	P, O
7.	Unit II	5	P
8.	Unit II	8	P, D
9.	Unit II	4	P
10.	Unit II	5	P, D
11.	Unit II	8	P
12.	Unit II	6	M, D
13.	Unit III	9	O
14.	Unit III	10	O, D
15.	Unit IV	11	O
16.	Unit IV	12	P, O
17.	Unit V	14	D, R
18.	Unit V	14	O, D
19.	Unit V	15	O, D, R
20.	Unit V	15	D, R
21.	Unit I	3	O
22.	Unit I	2	O, R
23.	Unit II	8	P, R
24.	Unit II	5	M, D
25.	Unit II	8	D
26.	Unit III	9	D, R
27.	Unit III	10	O, D, R
28.	Unit III	13	O, R
29.	Unit III	13	O, R
30.	Unit IV	11	M

P: Procedural skills; M: Manipulative skills; O: Observational skills;  
D: Drawing skills; R: Reporting and interpretative skills

## **ACKNOWLEDGEMENTS**

The Board gratefully acknowledges the rich contributions made by the following experts in the development of this material.

Prof. Arvind Kumar

Prof. Chitra Natrajan

Prof. S.C.Agarkar

Dr. N.K. Sehgal

Dr. Bharati Sarkar

Mr. V.G. Gambhir

Ms. Sumitra Yadav

Mr. V.D. Lale

Ms. Vijayalakshmi Srivatsan

Ms. Margret Davidraj

Mr. V.C. Sonawane

Mr. N.D. Deshmukh

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**Assessment of Practical Skills in  
Science and Technology through Written Test  
(Sample Question Papers)**

**Class IX**



**Central Board of Secondary Education  
Preet Vihar, Delhi 110092.**

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## FOREWORD

Curriculum changes worldwide are putting increased emphasis on the acquisition of skills. It is now well established and accepted that learning in any subject, and particularly in Science and Technology, should not remain restricted to just gaining of knowledge about facts and principles but should also include acquisition of practical skills by the learners in order to extend their understanding of the world around them, be it associated with physical phenomenon, materials or living things.

Experiments and practical work is essential for learning of Science and Technology. It promotes learning in the subject in many ways. Firstly, it conveys to the students a message that Science and Technology is about the real world around them and not merely a collection of formal definitions, formulas and laws. Secondly, past experience confirms that doing of experiments is an effective way to create interest in the subject among students. Once, the interest in the subject is kindled, it improves the overall competence as well as academic attainment of the learners in the subject. More importantly, the practical work promotes basic skills and competencies such as procedural and manipulative skills, observational skills and skills of representing and interpreting data.

The importance of experiments in Science education has been recognized in national policy of education for the past several decades. However, not much success appears to have been achieved in this direction. The problem is complex and arises due to combination of several factors. In view of different logistics involved in assessing experimental work for large number of students appearing in the subject, particularly at secondary stage, the practical work and acquisition of related skills appears to have been unfortunately marginalized and neglected. In order to stop this practice and to strengthen interest in science practicals, the Board is introducing the new scheme of assessment of practical skills through a written test also as part of its evaluation procedure. It is hoped that the initiative will be an important step not only to give experiments their due place in the subject of Science and Technology but also to promote, in general, an experimental culture in our school system.

I take this opportunity to put on record my heartfelt and sincere thanks to Homi Bhabha Centre for Science Education, Bombay for extending its academic expertise and providing physical facilities for development of this material during a six-day workshop organized by

the Board at this centre. The rich and immensely creative contributions made to the development and finalization of this material by Prof. Arvind Kumar, Director, HBCSE is gratefully acknowledged. The honest efforts put in by Prof. Chitra Natrajan, Prof. S.C.Agarkar, Mr. V.G.Gambhir and other faculty members of the centre are thankfully acknowledged. Sincere thanks are also due to other eminent subject experts from Delhi and Chennai who worked over time and have richly contributed to the development of this material. My deep appreciation and thanks are also due to Shri G.Balasubramanian, Director(Academic), CBSE and Shri R.P.Sharma, E.O(Science), CBSE for putting in their honest efforts in designing of this material and publication of this document.

It is hoped that concerted efforts will be put in by all schools and subject teachers to make best use of this document and make learning of the subject a joyful experience for learners.

Feedback and suggestions from users for further improvement of this document will be highly appreciated.

**ASHOK GANGULY**  
(CHAIRMAN)



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No. of Copies : 20,000

June, 2005

Price :

*Published by* : Secretary, Central Board of Secondary Education, 'Shiksha Kendra',  
2, Community Centre, Preet Vihar, Delhi-110092

*Designed & Printed by* : R. R. Enterprises, Delhi-110051.