CBSE PROFICIENCY TEST IN SCIENCE – 2012

Maximum Marks: 100 Time: 2.5 hours

General Instructions

- This question paper consists of 15 pages and contains 39 questions. All questions are compulsory.
- The questions are divided into three sections:
  1. **Section I**: Questions 1 to 32 are **Multiple Choice Questions**. Each multiple choice question has four options out of which only ONE option is correct. Each correct answer earns a credit of 2 marks. **A wrong answer carries a penalty of $-\frac{2}{3}$ mark**.
  2. **Section II**: Questions 33 to 35 are **Numerical Questions**. Each correct answer earns a credit of 4 marks. There is no negative marking for these questions.
  3. **Section III**: Questions 36 to 39 are **Column-matching Questions**. In these questions, there are 3 items in the left column (Column I) and 6 options in the right column (Column II). You have to match each item in Column I with ALL the correct options in Column II. For each item in Column I, you earn 2 marks if all correct matches in Column II are indicated, and no incorrect matches are indicated. There is no negative marking for these questions.
- For all types, an unanswered question earns no mark.

Instructions for writing on the Answersheet

- Use an HB pencil to fill the Answersheet. DO NOT USE A PEN.
- If you want to change an entry after filling a bubble, erase the filled bubble cleanly and fill in the new bubble of your choice.
- Apart from filling in bubbles for answers and roll number, do not write anything else on the Answersheet.
- Roll Number: The following example illustrates the correct way of writing your Roll Number.

Example:

Suppose your roll number is **2093184**.
Write it out in the box provided at the top of the grid in the Answersheet. Then for every digit in the roll number, fill in the appropriate bubble in the corresponding column, as shown.

Roll Number

2	0	9	3	1	8	4
⓪	●	⓪	⓪	⓪	⓪	⓪
①	①	①	①	●	①	①
●	②	②	②	②	②	②
③	③	③	●	③	③	③
④	④	④	④	④	④	●
⑤	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	●	⑧
⑨	⑨	●	⑨	⑨	⑨	⑨

Instructions continued on last page

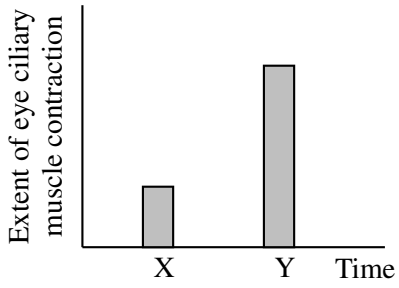
Section I: Multiple Choice questions

This section contains 32 *questions.*
For questions 1 *to* 32 *only one of the four options is correct. You have to indicate your answer by filling the appropriate bubble in the Answersheet. A correct answer will earn* 2 *marks, a wrong answer will earn* $(-\frac{2}{3})$ *mark, and an unattempted question will earn 0 mark.*

1. A student was carrying out an experiment. She had yeast cell suspension in two tubes X and Y. Tube X had been stored in the fridge (4° C) while the suspension in tube Y had been boiled for 10 minutes. Both were brought to room temperature. Sucrose was added to both the tubes and after keeping them at 37° C for 20 minutes, a reagent to detect the product formed by change in colour was added. What will be the expected result?

(A) There will be colour change in X but not in Y.
(B) There will be colour change in both X and Y.
(C) There will be no colour change in either X or Y.
(D) There will be colour change in Y but not in X.

2. The extent of eye ciliary muscle contraction at two different times during daytime is depicted in the graph below:



A possible interpretation about the situations at times X and Y could be:

(A) X: Honey bee viewing a nearby object
Y: Honey bee viewing a far-away object
(B) X: Bird viewing a nearby object
Y: Bird viewing a far-away object
(C) X: Human viewing a far-away object
Y: Human viewing a nearby object
(D) X: Mosquito viewing a far-away object
Y: Mosquito viewing a nearby object

Space for rough work

3. Two types of cells were taken on slides P and Q. Ion-free distilled water was added to each of these samples and observed under a microscope after 5 minutes. The sample from P appeared swollen, while no intact cells were found in Q. What kind of cells could have been in P and Q initially?

(A) Human RBCs and leaf cells respectively

(B) Onion cells and human RBCs respectively

(C) Yeast cells and leaf cells respectively

(D) Human RBCs and potato cells respectively

4. Liver is a vital organ in most organisms, particularly all vertebrates. Identify the correct combination of statements which is true about the liver.

(I) It secretes a hormone for controlling sugar level in the blood.

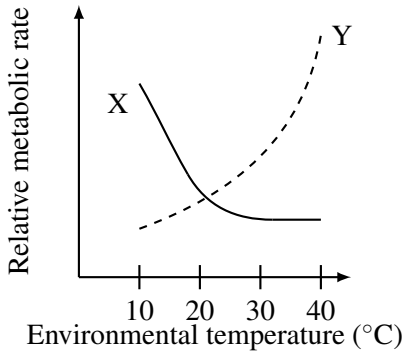
(II) It converts excess glucose into glycogen and vice versa.

(III) It secretes digestive enzymes.

(IV) It plays a major role in the breakdown of hemoglobin.

(A) (I) and (IV)
(B) (II) and (III)
(C) (III) and (IV)
(D) (II) and (IV)

5. A graph of the changes in the relative metabolic rate with respect to environmental temperature for two animals X and Y is given below:



X and Y most probably represent:

(A) X: Moth; Y: Cat
(B) X: Frog; Y: Salamander
(C) X: Rabbit; Y: Rat
(D) X: Mouse; Y: Lizard

Space for rough work

6. What is usually true about coastal breeze in the summer months?

(A) It blows from land to sea during day and sea to land during night.

(B) It blows from sea to land during day and land to sea during night.

(C) It blows from land to sea during both day and night.

(D) It blows from sea to land during both day and night.

7. Select an appropriate sequence of organisms on the basis of their appearance in the geological time scale.

(A) Starfish, lung fish, dinosaur, horse
(B) Starfish, dinosaur, horse, lung fish
(C) Dinosaur, lung fish, starfish, horse
(D) Lung fish, starfish, horse, dinosaur

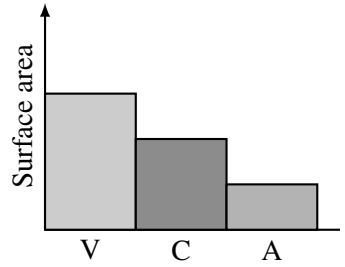
8. A couple has four children with four different blood groups: A, B, AB and O. The blood groups of the parents are likely to be

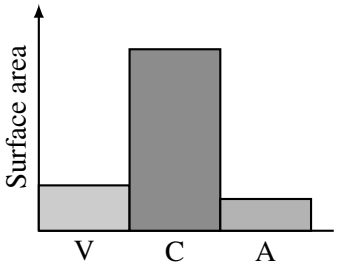
(A) A and A (B) AB and O (C) A and AB (D) A and B

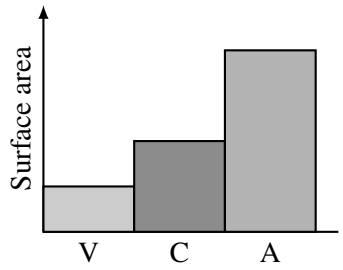
9. Which of the following is NOT a disease due to nutritional deficiency?

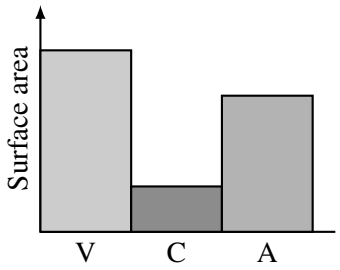
(A) Anaemia (B) Scurvy (C) Diabetes (D) Goitre

10. A graph representing the surface area of veins (V), capillaries (C) and arteries (A) in the human body would look like (note: the graph is not to scale):

(A)


(B)


(C)


(D)


Space for rough work

11. Consider a pair of elements ^{63}X and ^{63}Y having neutron numbers 32 and 30 respectively. Then

(A) the pair represents isotopes.

(B) the pair has similar chemical properties.

(C) the pair has proton numbers 32 and 30 respectively.

(D) the outermost electrons are in the N shell.

12. The scattering of an α-particle by 180° in Rutherford's experiment is due to a direct collision with

(A) an electron in the gold foil.
(B) a proton in the gold foil.
(C) a neutron in the gold foil.
(D) a nucleus in the gold foil.

13. A rural family needs to keep 10 litres of water cold on a hot dry day. The following options about material, shape and place of storage are available.

(I) Earthen vessel

(II) Metal vessel

(III) Spherical vessel

(IV) Oblong or cylindrical vessel

(V) Open shaded place like a courtyard

(VI) Closed place like the corner of a kitchen

Which of the above options will help to keep the water cold?

(A) (I), (IV) and (V)
(B) (I), (III) and (VI)
(C) (II), (III) and (VI)
(D) (II), (IV) and (V)

14. From the following lists, identify the one which contains species with the same number of electrons:

(A) Na^+, Mg, Ca^{2+}
(B) H^-, He, Li^-
(C) Na^+, F^-, O^{2-}
(D) Fe^{3+}, Co^{2+}, Ni^{2+}

15. The chemical equation

$$Al + O_2 \rightarrow Al_2O_3$$

is unbalanced. When we balance the equation using the smallest whole numbers the sum of the coefficients of all species is

(A) 9 (B) 7 (C) 5 (D) 4

Space for rough work

16. A compound is approximately 86% carbon and 14% hydrogen by mass. The chemical formula of this compound is most likely

(A) C_6H_6 (B) C_2H_4 (C) C_2H_6 (D) CH_4

17. A good method to separate alum (phitkari) from impure samples is

(A) filtration.
(B) sedimentation.
(C) crystallisation.
(D) sublimation.

18. The correct statement concerning the number of bonds present in the isomers of the hydrocarbon C_5H_{12} is that

(A) the total number of bonds is 16.

(B) the total number of bonds is 17.

(C) the total number of bonds is 32.

(D) the total number of bonds depends on the isomer.

19. In a homologous series the fourth member has the chemical formula C_4H_9OH. The ninth member of the same homologous series has the chemical formula

(A) $C_9H_{14}OH$ (B) $C_9H_{16}OH$ (C) $C_9H_{19}OH$ (D) $C_9H_{24}OH$

20. A boy buys common salt from the market which is contaminated with NH_4Cl and sand. The procedure he should adopt to obtain pure NaCl is the following:

(A) to mix the sample in water and evaporate the solution.

(B) to mix the sample in water and evaporate the decanted solution.

(C) to mix the sample in acetone and evaporate the decanted solution.

(D) to heat the sample, then mix in water and evaporate the decanted solution.

21. The elements F, Cl, Br and I belong to the same group of the periodic table. The correct order of their reactivity is

(A) $F > Cl > Br > I$
(B) $F > I > Br > Cl$
(C) $F < Cl < Br < I$
(D) $F < I < Br < Cl$

Space for rough work

22. A cube of ice is floating in a glass of water such that 1/10 of the cube is above the water level. If this arrangement is taken to the moon (while maintaining same ambient pressure and temperature) where acceleration due to gravity is one sixth of that of the earth, then the fraction of the cube which will be above the water level will be

(A) 1/60 (B) 1/10 (C) 3/5 (D) 2/5

23. If you accidentally breathe in helium gas, your voice sounds much higher pitched than usual. This is because

(A) inhalation of helium affects the elasticity of the vocal chords which alters your voice.

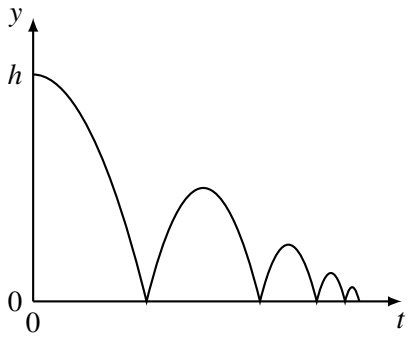
(B) lower density of helium causes an increase in the amplitude of sound.

(C) higher speed of sound in helium than in air causes an increase in the wavelength of sound.

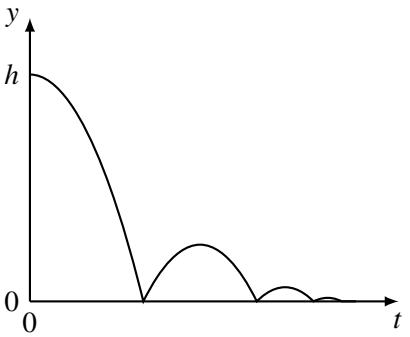
(D) higher speed of sound in helium than in air causes an increase in the frequency of sound.

24. A ball is dropped vertically on to horizontal hard ground from a height h. If the ball loses half its speed each time it bounces on the ground, which of the following graphs best represents the variation of its vertical height y above the ground with time t for the first few bounces? (The graphs are drawn to scale.)

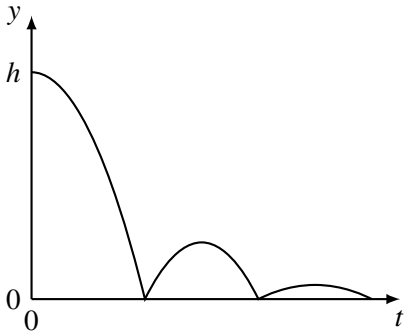
(A)



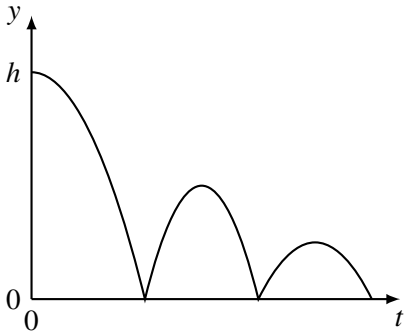
(B)



(C)

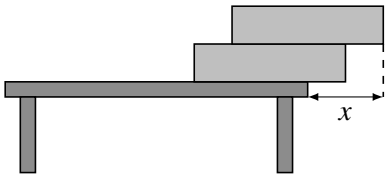


(D)



Space for rough work

25. Two uniform identical rectangular blocks of dimensions $12\,\text{cm} \times 10\,\text{cm} \times 2\,\text{cm}$ are placed one on top of the other at the edge of a rectangular table such that the edges of the blocks and the table are parallel, as shown below.



What is the maximum value of the horizontal distance (x) by which an edge of the top block can hang out from the edge of the table before toppling over?

(A) 9 cm (B) 6 cm (C) 7.5 cm (D) 10.5 cm

26. Two friends of equal mass m are standing on a stationary wagon of mass M mounted on frictionless horizontal rails. Each of them can jump off the back of the wagon on to the track at a speed of u with respect to it. They have the choice of jumping off one by one, or both at the same time. The final speed attained by the wagon is

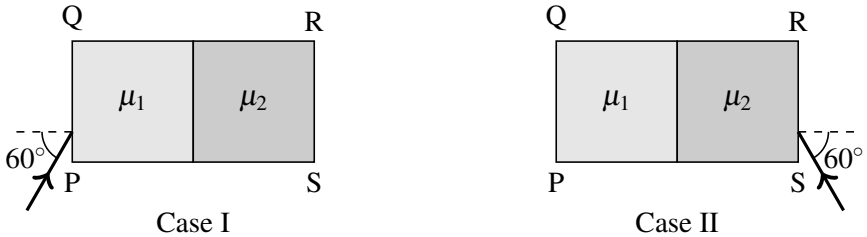
(A) larger when they jump off one by one.

(B) larger when they jump off together.

(C) equal in both the cases.

(D) larger in the first case or the second, depending on the m/M ratio.

27. A rectangular block PQRS is made of two slabs of glass with refractive indices $\mu_1 = \sqrt{\frac{3}{2}}$ and $\mu_2 = \sqrt{3}$, respectively. Consider the two cases I and II shown below where a monochromatic ray of light is incident at an angle of 60° with respect to the normal on the face PQ (Case I) and face RS (Case II).



The ray of light emerges from the opposite face RS in Case I and PQ in Case II of the block. The angle between the emergent ray and the normal is θ_I and θ_II in the two cases, respectively. Then

(A) $\theta_\text{I} > 60^\circ > \theta_\text{II}$ (B) $\theta_\text{I} < 60^\circ < \theta_\text{II}$ (C) $\theta_\text{I} = \theta_\text{II} = 60^\circ$ (D) $\theta_\text{I} = \theta_\text{II} \neq 60^\circ$

Space for rough work

28. Amit has myopia. His near point and far point of vision are at 25 cm and 120 cm, respectively. Standing 90 cm in front of a plane mirror he holds up a pencil 30 cm in front of his eye. Then

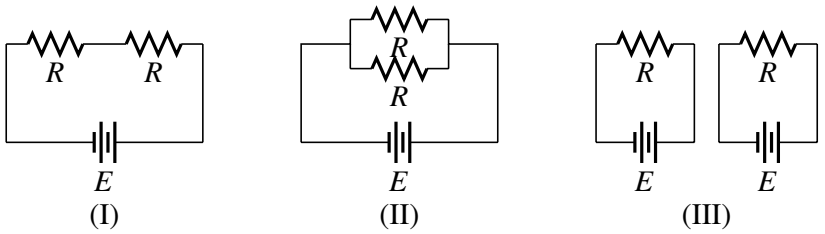
(A) he can see both the pencil and its image clearly.

(B) he can see the pencil clearly but not its image.

(C) he can see the image of the pencil clearly but not the pencil itself.

(D) he cannot see either the pencil or its image clearly.

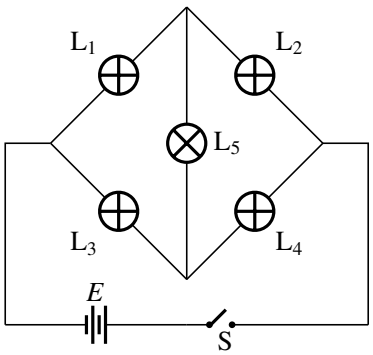
29. Two identical heating elements each of resistance R are connected in the configurations as shown below. All the batteries have the same e.m.f. E and negligible internal resistance.



The total power dissipated by the two heating elements in the three configurations are P_{I}, P_{II}, and P_{III}, respectively. Then the ratio $P_{\mathrm{I}} : P_{\mathrm{II}} : P_{\mathrm{III}}$ is

(A) 1 : 2 : 2 (B) 1 : 2 : 4 (C) 1 : 4 : 4 (D) 1 : 2 : 1

30. Five identical lamps, L_1 to L_5, are connected to a battery E in the circuit shown below.



When the switch S is closed

(A) all lamps will glow.

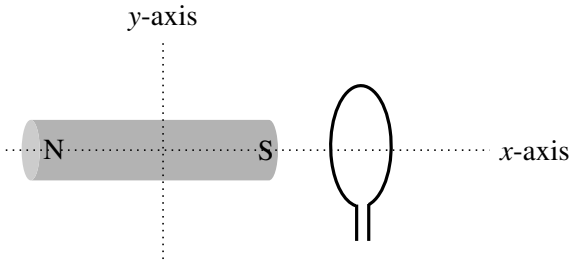
(B) only lamp L_5 will glow.

(C) all lamps except L_5 will glow.

(D) none of the lamps will glow.

Space for rough work

31. A bar magnet is placed near a circular loop of copper wire such that the axis of the magnet (x-axis in the diagram below) is perpendicular to the plane of the loop and passes through its centre, as shown.



Four independent motions of the magnet and the loop are performed:

(I) The magnet is moved along the x-axis towards the loop at a speed v, keeping the loop still.

(II) Both the magnet and the loop are moved in the same direction along the x-axis at a speed v.

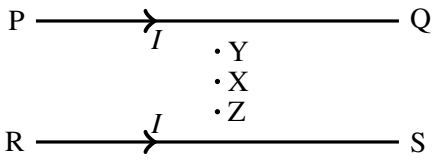
(III) The loop is rotated about the x-axis, keeping the magnet still.

(IV) The magnet is rotated about the y-axis, keeping the loop still.

For which of the above motions will e.m.f. be induced in the circular loop?

(A) Only (I) and (II)
(B) Only (III) and (IV)
(C) Only (I), (II) and (IV)
(D) Only (I) and (IV)

32. Two fixed long parallel wires PQ and RS both carry currents I in the same direction, as shown. The magnetic field at a point X lying in the plane of the wires midway between them is zero, i.e., X is a magnetic neutral point.



Now if the current in the wire PQ is doubled to $2I$, keeping the current in RS the same, then

(A) the magnetic neutral point remains at X.

(B) the magnetic neutral point moves towards the point Y.

(C) the magnetic neutral point moves towards the point Z.

(D) there is no magnetic neutral point between the wires.

Space for rough work

Section II: Numerical questions

This section contains 3 *questions.*
For questions 33 *to* 35 *the answer is an integer between* 0 *and* 99. *You have to indicate the answer by filling bubbles in the appropriate grid provided in the Answersheet. Each question carries* 4 *marks.*

33. An ecologist wanted to estimate the population of a species of fish in a pond. He immersed a net into the pond and collected 12 fish of this species. He marked them and released all the marked fish back into the pond. After a week, he captured 25 fish of the same species. He found 4 marked fish among these 25 fish. Assuming that there is no change in the population of fish during this period, estimate the number of fish of that species in the pond.

34. The number of oxygen atoms in 20 grams of sulphur trioxide is the same as that present in X grams of ozone. The atomic mass of sulphur and oxygen are 32 u and 16 u respectively. Find the value of X.

35. A 12 mm tall object is placed 64 cm away from a wall. A convex lens can be placed between the two in such a way that a sharp inverted image of length 4 mm is formed on the wall. How far away (in cm) from the wall must the same object be placed such that the same lens produces a sharp inverted image of length 6 mm on the wall? (The position of the lens may be changed.)

Section III: Column-matching questions

This section contains 4 *questions.*
For questions 36 *to* 39 *you have to match the options in Column II for each item in Column I. You have to indicate the matches by filling bubbles in the appropriate grid provided in the Answersheet. If* **all correct options are matched, and no incorrect option is matched**, *each item in Column I earns* 2 *marks.*

36. Column I below lists three kinds of plant tissues. Column II gives some functions and properties of them. For each item in Column I, match ALL the correct options in Column II.

Space for rough work

Column I	Column II
(i) Sclerenchyma	(A) High rate of cell division
(ii) Parenchyma	(B) Thin cell walls
(iii) Meristem	(C) Made of dead cells
	(D) Made of living cells
	(E) Stores food
	(F) Provides mechanical support

37. Column I below lists groups of plants. Column II gives some characteristics of these plants. For each item in Column I, match ALL the correct options in Column II.

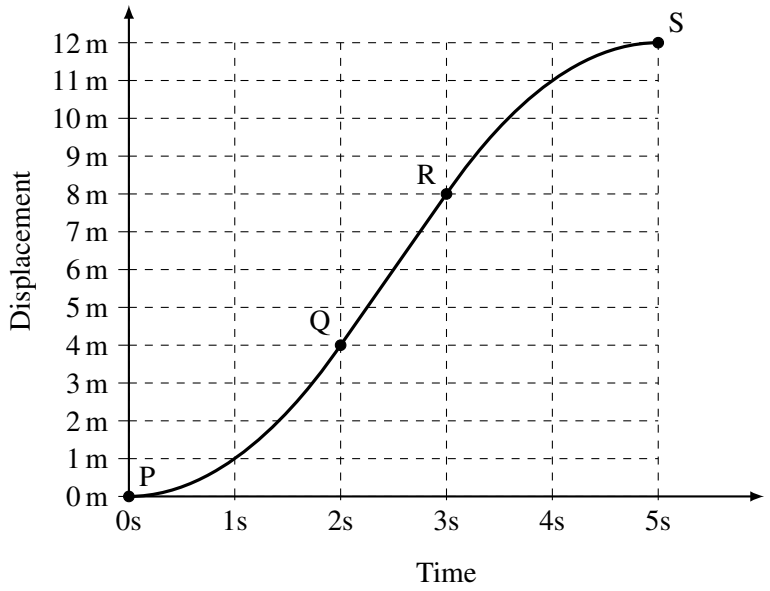
Column I	Column II
(i) Bryophyta	(A) Vascular bundle for water transport
(ii) Pteridophyta	(B) No flowers or fruits in any season
(iii) Gymnosperms	(C) Well-differentiated roots
	(D) Trees with woody stem
	(E) Mostly grow in moist and shady areas
	(F) Leaf-like structures without veins

38. Column I lists elements which occur sequentially in the same period (row) of the periodic table. Column II lists some properties of these substances. For each item in column I match all correct options in column II.

Column I	Column II
(i) $^{24}_{12}$Mg	(A) Metal
(ii) $^{27}_{13}$Al	(B) Solid at room temperature
(iii) $^{28}_{14}$Si	(C) Equal number of protons and neutrons
	(D) Largest atomic radius among Mg, Al, Si
	(E) Most electronegative among Mg, Al, Si
	(F) Valence electrons are in the M-shell

Space for rough work

39. The time–displacement curve for a body of mass 1 kg in rectilinear motion is shown below. The curves PQ and RS are parabolas, while QR is a straight line.



Column I lists three distinct time intervals, while Column II lists some statements about the motion of the body. For each item in Column I, match ALL the correct options in Column II.

Column I	**Column II**
(i) $t = 0$ s to $t = 2$ s	(A) Distance covered is 4 m.
(ii) $t = 2$ s to $t = 3$ s	(B) Velocity is constant.
(iii) $t = 3$ s to $t = 5$ s	(C) Acceleration is non-zero and constant.
	(D) No work is done.
	(E) Force and velocity are in the same direction.
	(F) Magnitude of work done is 8 J.

Space for rough work

Instructions for writing on the Answersheet (contd.)

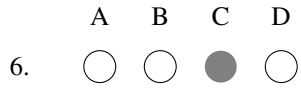
- Multiple Choice Questions: The following example illustrates the correct way of answering a Multiple Choice Question.

Example:

6. The disease cholera is caused by

(A) a virus. (B) a protozoan microbe. (C) a bacterium. (D) a fungus.

Answer: The answer to this question is option (C). You have to mark it on the Answersheet as shown.

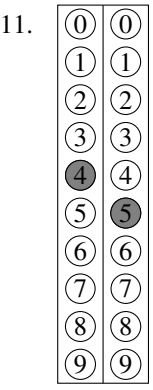


- Numerical Questions: The following example illustrates the correct way of answering a Numerical Question.

Example:

11. An ant crawls the distance of 1.5 m between its nest and a crystal of sugar in 2 minutes, travelling at uniform speed in a straight line. What is its speed in metres per hour?

Answer: The answer is 45. You have to indicate the answer by filling the bubble containing "5" in the right column, and the bubble containing "4" in the left column of the grid in the Answersheet, as shown.



Note: The answer to every Numerical Question is an integer between 0 and 99. If the answer is a single digit, for example, 5, enter it as "05". If the answer is zero, enter it as "00".

- Column-matching Questions: The following example illustrates the correct way of answering a Column-matching question.

Example:

14. Column I below lists three atoms. Column II lists some properties of atoms. For each item in Column I, match ALL the correct options in Column II.

Column I	**Column II**
(i) Hydrogen atom	(A) Has only one proton.
(ii) Tritium atom	(B) Does not have any electron.
(iii) Helium atom	(C) Has two neutrons.
	(D) Has a valency of 1.
	(E) Is electrically neutral.
	(F) Has a partially filled electronic shell.

Answer: The correct matches for this question are:
(i): (A), (D), (E), (F)
(ii): (A), (C), (D), (E), (F)
(iii): (C), (E)
You have to indicate the answer as shown.