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Sample Questions for Selection Test

Physics, Chemistry and Mathematics

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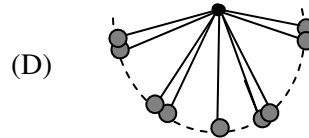
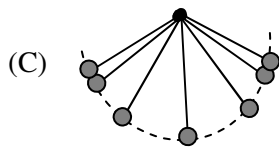
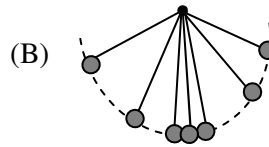
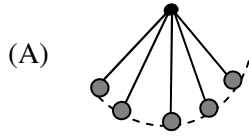
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The sample paper consists of multiple choice questions from Physics, Chemistry and Mathematics. Questions in each subject will be under 2 parts: Part A and Part B. Part A is aimed at evaluating skills of Observation, Comprehension, Analytical Reasoning and Computation. Questions in Part B are designed to assess Self-learning abilities, creative thinking and abstract reasoning.

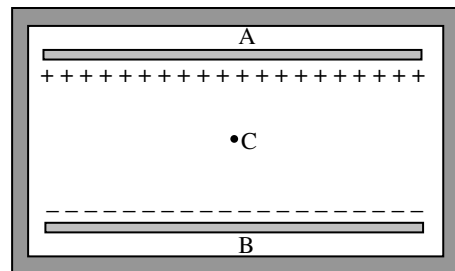
Part A

Multiple choice questions with one correct alternative.

1. The diagram that shows the positions of a simple pendulum at equal time intervals while oscillating is



2. In the figure shown, plates A and B are held horizontally one above the other. A is positively charged and B is negatively charged. The arrangement is enclosed in evacuated chamber. It is observed that when a charged oil drop is released from rest at point C, it descends with certain acceleration. Then the acceleration of the drop is



- (i) $a = g$
- (ii) $a > g$, if it is positively charged
- (iii) $a \neq g$
- (iv) $a < g$, if it is negatively charged

- (A) (i) (B) (ii) and (iv)
- (C) (ii) (D) (ii), (iii) and (iv)

3. Little Chintoo is busy in watching a transverse wave travelling on a rope from left to right. If 20 waves each of length 1 m pass past him in 12 s, the wave speed is

- (A) $\frac{3}{5} \text{ m s}^{-1}$ (B) $\frac{5}{3} \text{ m s}^{-1}$
- (C) $\frac{3}{10} \text{ m s}^{-1}$ (D) $\frac{6}{10} \text{ m s}^{-1}$

4. Voltage V (in volts) across and current I (in mA) through four devices are recorded as under. From the data, determine which device/s obey Ohm's law.

(I)

V	I
2	4.5
3	6.75
4	9

(II)

V	I
2	1.5
3	2.2
4	2.8

(III)

V	I
2	4
3.25	6.5
4.5	9

(IV)

V	I
2	8
3	16
4	27

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

Read the following passage and answer the questions from 5 to 7 by choosing the correct alternative.

The fictional traveller Gulliver spent a busy time in a kingdom called Lilliput, where all living beings — men, cattle, trees, grass etc., were exactly similar to the corresponding things in our world, except that they were all built on the scale of one inch to the foot. Lilliputians were a little under six inches high, on the average, and built proportionately just as we are. Gulliver also visited Brobdingnag, the country of the giants, who were exactly like men but twelve times as tall. As Jonathan Swift described it, daily life in both kingdoms was about like ours. Though his commentary on human behaviour is still worth reading, such human beings both dwarfs and giants — cannot exist.

Strength of a structure (bones, pillars etc) depend on their cross-sectional area i.e., on L^2 , where L characterizes the linear dimension. The weight that must be carried by the structure depends on its volume i.e., on L^3 . These two relations place an upper limit on the size of living creatures.

Surface area is proportional to L^2 . Hence biological and physical characteristics that are affected by interrelationships between surface area (L^2) and volume (L^3) are altered markedly by changes in scale. As any system is scaled up, the load will eventually be greater than the strength of the structure.

In physical investigations, it is often helpful to examine how a system's behaviour changes as its dimensions are scaled up or down. A study of systems built on unusual scales often discloses unsuspected physical relationships.

5. The leg bones of one animal A are twice as strong as those of another B, closely related animal of similar shape.
 - (A) The ratio of height of A to the height of B is $\sqrt{2}$
 - (B) The ratio of height of A to the height of B is 2
 - (C) The ratio of weight of A to the weight of B is $\sqrt{2}$
 - (D) The ratio of weight of A to the weight of B is 8
6. A rectangular water tank is supported above the ground by four pillars 5 m long whose diameters are 20 cm. If the tank were made 10 times longer, wider and deeper,
 - (A) the height of the pillars must be increased by a factor of 10
 - (B) the cross-sectional area of the pillars must be increased by a factor 10^2
 - (C) the diameter of the pillars must be increased by a factor of $10^{\frac{3}{2}}$
 - (D) the volume of the pillars must be increased by a factor of 10^3
7. In a zoo, an elephant of mass 8.0×10^3 kg consumes 4×10^2 times as much food as a guinea pig of mass 1 kg. They are both warm blooded, plant eating, similarly shaped animals. The ratio of their surface areas is

(A) 40	(B) 400	(C) 8×10^3	(D) 8×10^2
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8. Suppose you are told that the linear size of every thing in the universe has been doubled overnight. You can detect this
 - (A) by looking at your image in the mirror.
 - (B) by looking at the sizes of houses and trees around
 - (C) by measuring the well known sizes of the objects by a metre stick.
 - (D) by measuring the velocity of light and comparing it with standard value.

Multiple choice questions with one or more than one correct alternative/s

9. The crewmen in a spaceship are discussing whether they could crack a walnut with a hammer. Crewman A says that hitting the walnut with the hammer would be no more effective than hitting it with a feather, because the hammer is weightless out in space. B states that even in weightless condition one body can exert force on another. C disagrees with B and says that bodies cannot exert forces on one another in weightless condition. D says that the walnut can be broken by hitting it with hammer.
- (A) A is correct; B is wrong
(B) B is correct; A is wrong
(C) A and C are both correct
(D) B and D are both correct

CHEMISTRY**Part A****Multiple choice questions with one correct alternative**

1. Which of these gaseous substances contains the maximum number of oxygen atoms?

0.1 mol
oxygen

(A)

0.1 mol
of ozone

(B)

1.6 g of
oxygen

(C)

0.48 g of
ozone

(D)

2. When a suspension of a plant product in water was shaken well with a solution of iodine in potassium iodide, a deep blue colour is obtained. This experiment suggests that the suspension contains
(A) glucose (B) proteins (C) vitamins (D) starch
3. An electron in an atom is present in its L-shell. If energy is supplied to the atom,
(A) the electron shifts to the K-shell (B) the electron shifts to the M-shell
(C) no change occurs (D) the atom becomes an anion.
4. Avogadro number is 6.022×10^{23} . The atomic mass of oxygen is 16. A volume of 5.6 litres of oxygen gas at STP corresponds to
(A) 0.25 mol of oxygen gas (B) 8 grams of oxygen gas
(C) about 1.5×10^{23} oxygen molecules (D) all of the above

Part B**Read the following passage and answer the questions from 5 to 7 by choosing the correct alternative.**

Many physical and chemical properties of substances can be explained using the concepts of mass and energy. Mass is the amount of matter and energy is the capacity to do work. In chemical reactions, energy mostly means heat. Generally chemical reactions release heat and are said to be exothermic. Reactions that absorb heat are said to be endothermic. An important principle is that the total mass of a system remains constant during a chemical reaction. According to Albert Einstein, mass can be converted to energy, if proper conditions are maintained. If m is the mass that is converted to energy then $E = mc^2$ where c is the velocity of light, which is a very large number and is a constant.

5. On heating, potassium permanganate dissociates to potassium manganate solid and oxygen. Each gram of potassium permanganate yields 0.79 gram of potassium manganate. The mass of oxygen given off
- (A) cannot be calculated since molecular formulae of these compounds have not been furnished
 - (B) is about 0.2 grams.
 - (C) is – 0.21 grams.
 - (D) is 1.79 grams.
6. Petrol can be burnt in oxygen to carbon dioxide and water vapour. 3 grams of petrol are burnt in 4.8 grams of oxygen completely. Which of the following statements is correct?
- (A) This reaction is exothermic.
 - (B) If a very sensitive balance were available, the water vapour and carbon dioxide together would weigh less than 7.8 grams.
 - (C) Both (A) and (B) are correct
 - (D) Neither (A) nor (B) is correct
7. The atom bomb is based on uranium. It suggests that the bomb explosion
- (A) process is fast.
 - (B) process is exothermic
 - (C) both (A) and (B)
 - (D) that the velocity of light increases.
8. Imagine that two new elements with atomic numbers 119 and 120 are discovered. Their properties would be
- (A) both the elements are non-metals, and their oxides are acidic.
 - (B) both the elements would be transition metals, with high melting and boiling points.
 - (C) the element with $Z = 119$ would be divalent whereas that with $Z = 120$ would be a non-metal showing variable valency.
 - (D) the oxides and hydroxides of the elements would be basic and water soluble.

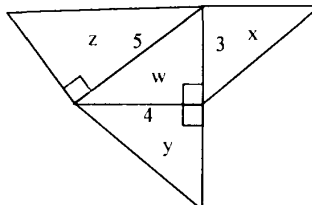
Multiple choice questions with one or more than one correct alternative/s

9. 'Green chemistry' aims for 'atom economy', and thereby reduce or eliminate new chemical products or processes to make them less harmful to human health and environment. In this perspective, which one among the following contributes to achieve the goal?
- (A) Using rechargeable Ni-Cd cells in cameras, calculators etc.
 - (B) Using H_2-O_2 fuel cell as a source of power.
 - (C) Using CFCs in place of CO_2 as blowing agents in foam mattresses.
 - (D) Fitting catalytic converters to automobile combustion-exhaust system.

Part A

Multiple choice questions with one correct alternative.

1. Right isosceles triangles are constructed on the sides of a 3 – 4 – 5 right triangle, as shown. Let w, x, y, z represent the areas as shown. Then



- (A) $x + z = w + y$
 (B) $w + x = z$
 (C) $3x + 4y = 5z$
 (D) $x + y = z$

2. For how many real numbers x , is $\sqrt{144 - \sqrt{x}}$ an integer?
 (A) 10 (B) 15 (C) 13 (D) 14
3. If a, b, c are real numbers such that $a^2 + 2b = 7$, $b^2 + 4c = -7$ and $c^2 + 6a = -14$, then $a^2 + b^2 + c^2$ is
 (A) 14 (B) 21 (C) 28 (D) 35
4. A thousand litre tank contains 50 litres of a 25% brine solution. If you have plenty of 75% brine solution, how many litres of 75% do you need to add to the tank to get a 30% brine solution?
 (A) $\frac{50}{9}$ (B) $\frac{47}{11}$ (C) $\frac{125}{17}$ (D) $\frac{77}{12}$

Section B

Study the following information carefully to answer the questions from 5 to 7.

A number sorting machine when given an input rearranges in a particular order as indicated below

Input	39	121	48	18	76	112	14	45	63	96
Step 1	14	39	121	48	18	76	112	45	63	96
Step 2	14	39	48	18	76	112	45	63	96	121
Step 3	14	18	39	48	76	112	45	63	96	121
Step 4	14	18	39	48	76	45	63	96	112	121
Step 5	14	18	39	45	48	76	63	96	112	121
Step 6	14	18	39	45	48	63	76	96	112	121

Step 6 is the last step for this input

5. What will be step 3 for the following input?

Input	68	182	39	93	129	46	21	58
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- (A) 21 39 68 129 93 46 58 182
 (B) 21 39 68 93 129 46 58 182
 (C) 21 68 39 93 129 46 58 182
 (D) Cannot be determined

6. Given below is the fifth step of an input. What will be the 3rd step?

Step 5	17	32	43	82	69	83	49	56	99	106
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- (A) 17 32 82 43 69 93 49 56 99 106
- (B) 17 32 82 69 43 93 49 56 99 106
- (C) 17 32 82 69 93 43 49 56 99 106
- (D) Cannot be determined

7. What is the last step for the following input?

Input	138	63	49	93	89	122	32	71
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- (A) 32 49 63 71 89 93 122 138
- (B) 32 49 71 63 89 93 122 138
- (C) 32 49 63 71 93 89 122 138
- (D) Cannot be determined

8. The minimum value of $1 * 2 * 3 * 4 * 5 * 6 * 7 * 8 * 9$, where * is either a '+' or '×', is

- (A) 36
- (B) 40
- (C) 44
- (D) 7

Multiple choice questions with one or more than one correct alternative/s

9. Consider the numbers 1, 2, 3, ..., 2006. Which of the following statements are true?

- (A) 668 numbers are divisible by 3
- (B) 401 numbers are divisible by 5
- (C) 936 numbers are divisible by 3 or 5 but not by 15
- (D) 803 numbers are divisible by 3 or 5 but not by 15

* * *

	Physics		Chemistry		Maths	
1.	C	1.	B	1.	D	
2.	D	2.	D	2.	C	
3.	B	3.	B	3.	A	
4.	C	4.	D	4.	A	
5.	A	5.	B	5.	B	
6.	C	6.	C	6.	D	
7.	B	7.	C	7.	A	
8.	D	8.	D	8.	C	
9.	B, D	9.	B, D	9.	A, B, D	