

**CHEMISTRY****SECTION – I****Single Correct Choice Type**

This section contains 7 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

- Partition coefficient of  $I_2$  in  $CCl_4$  and  $H_2O$  is 400 at a given temperature. 10 mL of  $CCl_4$  solution containing 1 g  $I_2$  is shaken with 0.4 L  $H_2O$ .  $I_2$  extracted into water when equilibrium is attained will be  
 (A)  $\frac{1}{11}$  g                      (B)  $\frac{10}{11}$  g                      (C)  $\frac{1}{10}$  g                      (D)  $\frac{1}{9}$  g
- $H_2O(l) \rightleftharpoons H_2O(g)$ ,  
 $\Delta H_{vap} = 10 \text{ kcal mol}^{-1}$ .  
 If pressure is increased  
 (A) steam is liquefied                      (B) b.p. of  $H_2O$  is elevated  
 (C) both (A) and (B)                      (D) none of these
- The rms speed of hydrogen is  $\sqrt{7}$  times the rms speed of nitrogen, if T is the temperature of the gas then  
 (A)  $T_{H_2} = T_{N_2}$                       (B)  $T_{H_2} > T_{N_2}$                       (C)  $T_{H_2} < T_{N_2}$                       (D)  $T_{H_2} > \sqrt{7} T_{N_2}$
- The molarity of orthophosphoric acid having purity of 70% by weight and specific gravity 1.54 would be  
 (A) 11 M                      (B) 22 M                      (C) 33 M                      (D) 44 M
- On reduction with hydrogen 3.6 g of an oxide of metal leaves 3.2 g of metallic residue. If the atomic mass of metal is 64, the formula of metal oxide is  
 (A)  $M_2O_3$                       (B)  $M_2O$                       (C) MO                      (D)  $MO_2$
- The following acids have been arranged in the order of decreasing acid strength Identify the correct order  
 (I) ClOH (II) BrOH (III) IOH  
 (A) I > II > III                      (B) II > I > III  
 (C) III > II > I                      (D) I > III > II
- For a p-block element, its 3d, 3s, 3p, and 4s orbitals are completely filled and the differentiating electron goes to the 4p orbital. The element should have its atomic number in the range  
 (A) 13 - 18                      (B) 21 - 26                      (C) 31 - 36                      (D) 49 - 54

**SECTION – II****Multiple Correct Choice Type**

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONE OR MORE is/are correct.

8. Which of the following statements are correct?  
 (A) Potassium bromate,  $\text{KBrO}_3$ , acts as a strong oxidizing agent. It accepts 6 electrons to give  $\text{KBr}$   
 (B) Potassium bromate can quantitatively convert  $\text{Br}^-$  to  $\text{Br}_2$   
 (C) Potassium iodate solution can be kept for a long time without decomposition  
 (D) In 3N  $\text{HCl}$  solution, iodate can oxidize  $\text{I}_2$  according to the reaction  

$$\text{IO}_3^- + 2\text{I}_2 + 10\text{Cl}^- + 6\text{H}^+ \rightarrow 5\text{ICl}_2^- + 3\text{H}_2\text{O}$$
 In this reactions, the equivalent mass of  $\text{IO}_3^-$  is molar mass divided by four
9. Consider following reaction  $\text{H}_3\text{PO}_4 + \text{Ca}(\text{OH})_2 \rightarrow \text{CaHPO}_4 + 2\text{H}_2\text{O}$  and select true statements  
 (A) Equivalent weight of  $\text{H}_3\text{PO}_4$  is 49  
 (B) Resulting mixture is neutralized by 1 mol of  $\text{KOH}$   
 (C)  $\text{CaHPO}_4$  is an acid salt  
 (D) 1 mol of  $\text{H}_3\text{PO}_4$  can be completely neutralized by 1.5 mol of  $\text{Ca}(\text{OH})_2$
10. Which of the following facts are correct?  
 (A) First ionization of calcium is more than that of potassium  
 (B) Second ionization of magnesium is more than that of aluminium  
 (C) Third ionization of beryllium is larger than that of carbon  
 (D) Second ionization of nitrogen is more than that of oxygen
11. Which of the following sets of elements would not have nearly same atomic radii?  
 (A) Na, K, Rb, Cs      (B) Na, Mg, Al, Si      (C) Fe, Co, Ni, Cu      (D) F, Cl, Br, I

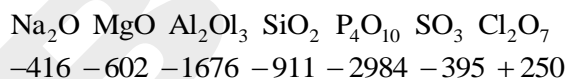
## SECTION – III

### Comprehension Type

*This section contains 2 groups of questions. Each group has 2 & 3 multiple choice questions based on a paragraph. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.*

#### Paragraph for Questions Nos. 12 to 13

The heats of formation ( $\Delta H_f^\circ$ ) of the oxides of the third period, sodium to chlorine, are in  $\text{kJ mol}^{-1}$



Based on these data, answer the following heat of formation

12. Which oxide has maximum negative heat of formation per oxygen atom?  
 (A)  $\text{P}_4\text{O}_{10}$       (B)  $\text{Al}_2\text{O}_3$       (C)  $\text{Na}_2\text{O}$       (D)  $\text{MgO}$
13. Most stable and least stable oxides are:  
 (A)  $\text{P}_4\text{O}_{10}$ ,  $\text{Cl}_2\text{O}_7$       (B)  $\text{Na}_2\text{O}$ ,  $\text{Cl}_2\text{O}_7$       (C)  $\text{MgO}$ ,  $\text{Cl}_2\text{O}_7$       (D)  $\text{Cl}_2\text{O}_7$ ,  $\text{MgO}$

#### Paragraph for Questions Nos. 14 to 16

Read the following passage regarding fertilizer  $\text{K}_2\text{O}$  and answer the questions at the end of it. Potash is any potassium mineral that is used for its potassium content. Most of the potash produced in the United states goes into fertilizer. The major sources of potash are potassium chloride ( $\text{KCl}$ ) and potassium sulphate ( $\text{K}_2\text{SO}_4$ ). Potash production is often reported as the

- potassium oxide ( $K_2O$ ) equivalent or the amount of  $K_2O$  that could be made from a given mineral. KCl costs Rs. 50 per kg.
14. What is the cost of K per mol of the KCl sample?  
 (A) Rs. 13.42  $\text{mol}^{-1}$  (B) Rs. 3.73  $\text{mol}^{-1}$   
 (C) Re. 1.00  $\text{mol}^{-1}$  (D) Rs. 2.00  $\text{mol}^{-1}$
15. For what price must  $K_2SO_4$  be sold in order to supply the same amount of potassium as in KCl?  
 (A) Rs. 58.40  $\text{kg}^{-1}$  (B) Rs. 50.00  $\text{kg}^{-1}$   
 (C) Rs. 42.82  $\text{kg}^{-1}$  (D) Rs. 25.00  $\text{kg}^{-1}$
16. What mass (in kg) of  $K_2O$  contains the same number of moles of K atoms as 1.00 kg KCl?  
 (A) 0.158 kg (B) 0.315 kg  
 (C) 1.262 kg (D) 0.631 kg

## SECTION – IV

### Integer Answer Type

This section contains 7 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y and Z (say) are 6, 0 and 9, respectively, then the correct darkening of bubbles will look like the following:

X	0	1	2	3	4	5	6	7	8	9
Y	0	1	2	3	4	5	6	7	8	9
Z	0	1	2	3	4	5	6	7	8	9

17. In the reaction  $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$ , the equivalent weight of  $Na_2S_2O_3$  (mol. wt. = M) is equal to \_\_\_\_\_ M
18. The ratio of the rate of diffusion of a given element to that of helium is 1.4. The molecular weight of the element is \_\_\_\_\_
19. 2 g of oxygen contains number of atoms equal to that in \_\_\_\_\_ g of Sulphur.
20. The densities of two gases are in the ratio of 1 : 16. If ratio of their rates of diffusion is  $x : 1$ . Find the value of  $x$ .
21. 30 g of a salt of molecular weight 30 is dissolved in 250 g of water. The molality of the solution is \_\_\_\_\_
22. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is \_\_\_\_\_
23. The molecular weight of a gas is 45. Its density at STP is \_\_\_\_\_

# MATHEMATICS

## SECTION – I

### Single Correct Choice Type

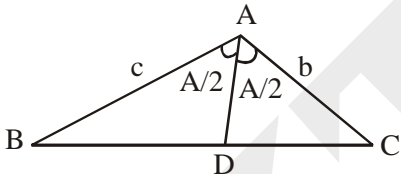
This section contains 7 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

24. Let  $U$  be the universal set and  $A \cup B \cup C = U$ . Then  $\{(A - B) \cup (B - C) \cup (C - A)\}'$  is equal to  
 (A)  $A \cup B \cup C$  (B)  $A \cup (B \cap C)$   
 (C)  $A \cap B \cap C$  (D)  $A \cap (B \cup C)$
25. If  $[\sin x] + [\sqrt{2} \cos x] = -3$ ,  $x \in [0, 2\pi]$ , ( $[.]$  denotes the greatest integer function) then  $x$  belongs to  
 (A)  $\left(\pi, \frac{5\pi}{4}\right)$  (B)  $\left[\pi, \frac{5\pi}{4}\right]$  (C)  $\left(\frac{5\pi}{4}, 2\pi\right)$  (D)  $\left[\frac{5\pi}{4}, 2\pi\right]$
26. Which of the following sets are null sets?  
 (i) The set of all prime numbers lying between 15 and 19  
 (ii)  $\{x : x < 5 \text{ and } x > 6\}$   
 (iii)  $\{x : x^2 = 16, x \in N\}$   
 (iv)  $\{x : |x| < -2, x \in N\}$   
 (A) (i) and (iii) (B) (ii) and (iv) (C) (i) and (iv) (D) (ii) and (iii)
27. Given  $f(x) = \frac{1}{\sqrt{|x|-x}}$  and  $g(x) = \frac{1}{\sqrt{x-|x|}}$ , then  
 (A)  $f(x)$  and  $g(x)$  are not defined for  $x \geq 0$  (B)  $D(f) = \phi$   $D(g) \neq \phi$   
 (C)  $D(f) = D(g) \neq \phi$  (D)  $D(f) = D(g) = \phi$
28. If  $aN = \{an : n \in N\}$  and  $bN \cap cN = dN$ , where  $a, b, c, \in N$  and  $b, c$  are coprime, then  
 (A)  $b = cd$  (B)  $c = bd$   
 (C)  $d = bc$  (D) None of these
29. The total number of solutions of  $[x]^2 = x + 2\{x\}$ , where  $[.]$  and  $\{.\}$  denote the greatest integer function and fractional part, respectively, is equal to  
 (A) 2 (B) 4 (C) 6 (D) None of these
30. If  $f(x) = \begin{vmatrix} \sin^2 \theta & \cos^2 \theta & x \\ \cos^2 \theta & x & \sin^2 \theta \\ x & \sin^2 \theta & \cos^2 \theta \end{vmatrix}$   $\theta \in (0, \pi/2)$  then roots of  $f(x) = 0$  are  
 (A)  $1/2, -1$  (B)  $1/2, -1, 0$  (C)  $-1/2, 1, 0$  (D)  $-1/2, -1, 0$

## SECTION – II

**Multiple Correct Choice Type**

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONE OR MORE is/are correct.

31.  $\sqrt{\cos 2x} + \sqrt{1 + \sin 2x} = 2\sqrt{\sin x + \cos x}$  if  
 (A)  $\sin x + \cos x = 0$  (B)  $x = 2n\pi$   
 (C)  $x = n\pi - \frac{\pi}{4}$  (D)  $x = 2n\pi \pm \cos^{-1}\left(-\frac{1}{5}\right)$
32. Let  $X = \{1, 2, 3, 4, 5\}$  and  $Y = \{1, 3, 5, 7, 9\}$ . Which of the following is/are relations from X and Y  
 (A)  $R_1 = \{(x, y) | y = 2 + x, x \in X, y \in Y\}$  (B)  $R_2 = \{(1, 1), (2, 1), (3, 3), (4, 3), (5, 5)\}$   
 (C)  $R_3 = \{(1, 1), (1, 3), (3, 5), (3, 7), (5, 7)\}$  (D)  $R_4 = \{(1, 3), (2, 5), (2, 4), (7, 9)\}$
33. In a triangle ABC, the length of the bisector of angle A is
- 
- (A)  $\frac{2bc \sin(A/2)}{b+c}$  (B)  $\frac{2bc \cos(A/2)}{b+c}$   
 (C)  $\frac{abc}{2R(b+c)} \operatorname{cosec} \frac{A}{2}$  (D)  $\frac{4\Delta}{b+c} \operatorname{cosec} \frac{A}{2}$
34. The value of integer n for which  $3\pi$  can be period of the function  $\cos nx \sin (5x/n)$  can be  
 (A) 3 (B) 5 (C) 15 (D) 20

**SECTION – III****Comprehension Type**

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**Paragraph for Questions Nos. 35 to 36**

In a group of children, 35 play football out of which 20 play football only, 22 play hockey; 25 play cricket out of which 11 play cricket only. Out of these 7 play cricket and football but not hockey, 3 play football and hockey but not cricket and 12 play football and cricket both.

35. How many play all the three games?  
 (A) 5 (B) 6 (C) 8 (D) 10
36. How many play cricket and hockey but not football?  
 (A) 1 (B) 2 (C) 3 (D) 4

**Paragraph for Questions Nos. 37 to 39**

O is the circumcentre of triangle ABC.  $R_1, R_2, R_3$  are the radii of the circumcircles of triangles OBC, OCA and OAB respectively.  $r_1, r_2, r_3$ , are the radii of the circles drawn on the altitudes OD,

OE and OF of these triangles respectively.  $\Delta_1, \Delta_2, \Delta_3$  being the respective areas of these triangles. R, r are respectively the circumradius and in radius of the triangle ABC,  $\Delta$  being its area and a, b, c be the lengths of the sides BC, CA and AB respectively.

37.  $\frac{a}{R_1} + \frac{b}{R_2} + \frac{c}{R_3} =$   
 (A)  $\frac{4\Delta_1}{R^2}$  (B)  $\frac{4\Delta}{R^2}$  (C)  $\frac{4}{R^2}(a+b+c)$  (D) none of these
38.  $\frac{a}{r_1} + \frac{b}{r_2} + \frac{c}{r_3} =$   
 (A)  $4 \tan A \tan B \tan C$  (B)  $4 \sin A \sin B \sin C$   
 (C)  $4 \cot A \cot B \cot C$  (D)  $4 \cos A \cos B \cos C$
39.  $\frac{R_1}{r_1} + \frac{R_2}{r_2} + \frac{R_3}{r_3} =$   
 (A)  $R^2 \left[ \frac{\sin A}{\Delta_1} + \frac{\sin B}{\Delta_2} + \frac{\sin C}{\Delta_3} \right]$  (B)  $R^2 \left[ \frac{\cos A}{\Delta_1} + \frac{\cos B}{\Delta_2} + \frac{\cos C}{\Delta_3} \right]$   
 (C)  $R^2 \left[ \frac{\tan A}{\Delta_1} + \frac{\tan B}{\Delta_2} + \frac{\tan C}{\Delta_3} \right]$  (D)  $R^2 \left[ \frac{\cot A}{\Delta_1} + \frac{\cot B}{\Delta_2} + \frac{\cot C}{\Delta_3} \right]$

### SECTION – IV

#### Integer Answer Type

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X	0	1	2	3	4	5	6	7	8	9
Y	0	1	2	3	4	5	6	7	8	9
Z	0	1	2	3	4	5	6	7	8	9

40. Given  $n(U) = 20$ ,  $n(A) = 12$ ,  $n(B) = 9$ ,  $n(A \cap B) = 4$ , where U is the universal set, A and B are subsets of U, then  $n((A \cup B)^c) =$
41. Number of solutions of the equation  $\tan x + \sec x = 2 \cos x$  lying in the interval  $[0, 2\pi]$  is \_\_\_\_\_
42.  $2 \cos 3B + 3 \cos 4A = 3$  and  $2 \sin 3B - 3 \sin 4A = 0$ , where 2A and 2B are positive acute angles. If  $2A + 3B = \frac{\pi}{J}$ , then find the value of J.

43. If  $\sin a = \frac{12}{37}$ ,  $a \in \left(\frac{\pi}{2}, \pi\right)$  and  $\cos b = \frac{20}{101}$ ,  $b \in \left(\frac{3\pi}{2}, 2\pi\right)$  then the value of  $\operatorname{cosec}(\alpha + \beta)$  can be expressed in the lowest form as  $\frac{p}{q}$  ( $p, q \in \mathbb{N}$ ) then find the value of  $\frac{(p+q)}{3721}$ .
44. In a  $\Delta ABC$ , angles  $A, B, C$  are in A.P. then  $\lim_{A \rightarrow C} \frac{\sqrt{3-4\sin A \sin C}}{|A-C|}$  is \_\_\_\_\_
45. If  $f\left(\frac{2 \tan x}{1 + \tan^2 x}\right) = \frac{(\cos 2x + 1)(\sec^2 x + 2 \tan x)}{2}$ , then  $f(4) =$  \_\_\_\_\_
46. Let  $X = \{1, 2, 3, \dots, 100\}$  and  $Y$  be a subset of  $X$  such that the sum of two elements in  $Y$  is not divisible by 7. If the maximum possible number of element in  $Y$  is  $40 + \lambda$ , then  $\lambda$  is \_\_\_\_\_

## PHYSICS

### SECTION – I

#### Single Correct Choice Type

This section contains 7 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

47. The resistance of a metal is given by  $R = \frac{V}{I}$ , where  $V$  is potential difference and  $I$  is the current. In a circuit the potential difference across resistance is  $V = (8 \pm 0.5) V$  and current in resistance,  $I = (4 \pm 0.2) A$ . What is the value of resistance with its percentage error?  
 (A)  $(2 \pm 5.6\%) \Omega$       (B)  $(2 \pm 0.7\%) \Omega$       (C)  $(2 \pm 35\%) \Omega$       (D)  $(2 \pm 11.25\%) \Omega$
48. A highly rigid cubical block  $A$  of small mass  $M$  and side  $L$  is fixed rigidly on the other cubical block of same dimensions and of low modulus of rigidity  $\eta$  such that the lower face of  $A$  completely covers the upper face of  $B$ . The lower face of  $B$  is rigidly held on a horizontal surface. A small force  $F$  is applied perpendicular to one of the side faces of  $A$ . After the force is withdrawn, block  $A$  executes small oscillations, the time period of which is given by  
 (A)  $2\pi\sqrt{M\eta L}$       (B)  $2\pi\sqrt{(M\eta/L)}$       (C)  $2\pi\sqrt{ML/\eta}$       (D)  $2\pi\sqrt{M/\eta L}$
49. Given  $|\vec{A}_1| = 2$ ,  $|\vec{A}_2| = 3$  and  $|\vec{A}_1 + \vec{A}_2| = 3$ . Find the value of  $(\vec{A}_1 + 2\vec{A}_2) \cdot (3\vec{A}_1 - 4\vec{A}_2)$   
 (A)  $-64$       (B)  $60$       (C)  $62$       (D)  $61$
50. What is the resultant of three coplanar forces: 300 N at  $0^\circ$ , 400 N at  $30^\circ$ , and 400 N at  $150^\circ$ ?  
 (A) 500 N      (B) 700 N      (C) 1,100 N      (D) 300 N
51. Taxies leave the station X for station Y every 10 min. Simultaneously, a taxi also leaves the station Y for station X every 10 min. The taxies move at the same constant speed and go from X and Y or vice-versa in 2h. How many taxies coming from the other side will meet each taxi enroute from Y and X?  
 (A) 24      (B) 23      (C) 12      (D) 11

52. A juggler keeps on moving four balls in the air throwing the balls after regular intervals. When one ball leaves his hand (speed =  $20 \text{ ms}^{-1}$ ) the position of other balls (height in m) will be (Take  $g = 10 \text{ ms}^{-2}$ )  
 (A) 10, 20, 10 (B) 15, 20, 15 (C) 5, 15, 20 (D) 5, 10, 20
53. The velocity of a particle at time  $t$  is given by the relation  $v = 6t - \frac{t^2}{6}$ . The distance traveled in 3 seconds is, if  $s = 0$  at  $t = 0$   
 (A)  $\frac{39}{2}$  (B)  $\frac{57}{2}$  (C)  $\frac{51}{2}$  (D)  $\frac{33}{2}$

## SECTION – II

### Multiple Correct Choice Type

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54. The pair of physical quantities that have the same dimensions (is / are)  
 (A) Reynolds number and coefficient of friction  
 (B) Latent heat and gravitational potential  
 (C) Curie and frequency of light wave  
 (D) Planck's constant and torque
55. A particle is projected from ground with speed  $u$  at an angle  $\theta$  with the horizontal. Radius of curvature of trajectory of the particle  
 (A) is minimum at highest point (B) is minimum at point of projection  
 (C) is same at all points (D) varies from  $\frac{u^2 \cos^2 \theta}{g}$  to  $\frac{u^2}{g \cos \theta}$
56. When a plane wave travels in a medium, the displacement  $y$  of a particle located at  $x$  at time  $t$  is given by  
 $y = a \sin (bt - cx)$   
 where,  $a$ ,  $b$  and  $c$  are constants.  
 (A) The unit  $a$  is the same as that of  $y$ .  
 (B) The SI unit of  $b$  is Hz.  
 (C) The dimensional formulæ of  $c$  is  $[M^0 L^{-1} T^0]$   
 (D) The dimensions of  $b/c$  are the same those of velocity
57. Two bodies of masses  $m_1$  and  $m_2$  are dropped from ground after time  $t_1$  and  $t_2$  respectively. They reach the ground after time  $t_1$  and  $t_2$  and strike the ground with speeds  $v_1$  and  $v_2$  respectively. Choose the correct relation from the following :
- (A)  $\frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$  (B)  $\frac{t_1}{t_2} = \sqrt{\frac{m_2 h_1}{m_1 h_2}}$   
 (C)  $\frac{v_1}{v_2} = \sqrt{\frac{h_1}{h_2}}$  (D)  $\frac{v_1}{v_2} = \sqrt{\frac{m_2 h_1}{m_1 h_2}}$

**SECTION – III****Comprehension Type**

This section contains 2 groups of questions. Group has 2 & 3 multiple choice questions based on a paragraph. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

**Paragraph for Questions Nos. 58 to 59**

Dimensional methods provide three major advantages in verification, derivation and changing the system of units. Any empirical formula that is derived based on this method has to be verified and proportionality constants. The presence or absence of certain factors-non dimensional constants or variables-cannot be identified by this method. So every dimensionally correct relation cannot be taken as perfect, found by experimental means correct.

58. If  $\alpha$  kg,  $\beta$  meter and  $\gamma$  seconds are the fundamental units, 1 calorie can be expressed in new units as [1 cal = 4.2 J] :
- (A)  $\alpha^{-1}\beta^2\gamma$                       (B)  $\alpha^{-1}\beta^{-2}\gamma$                       (C)  $4.2\alpha^{-1}\beta$                       (D)  $4.2\alpha^{-1}\beta^{-2}\gamma^2$
59. Time period of oscillation of a drop depends on surface tension  $\sigma$ , density of the liquid  $\rho$  and radius  $r$ . The relation is
- (A)  $\sqrt{\frac{\rho r^2}{\sigma}}$                       (B)  $\sqrt{\frac{r^2}{\rho\sigma}}$                       (C)  $\sqrt{\frac{r^3\rho}{\sigma}}$                       (D)  $\sqrt{\frac{\rho\sigma}{r^3}}$

**Paragraph for Questions Nos. 60 to 62**

Projectile motion is a combination of two one dimension motion. One in horizontal and other in vertical. Motion in 2D means motion in a plane. Necessary condition for 2D motion is that the velocity vector is coplanar to the acceleration vector. In case of projectile motion, the angle between velocity and acceleration will be  $0 < \theta < 180$ . During the projectile motion the horizontal component of velocity remains unchanged but vertical component of velocity is time dependent.

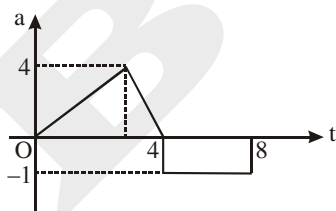
60. A particle is projected from the origin in X-Y plane. Acceleration of particle in Y direction is  $\alpha$ . If equation of path of the particle is  $y = ax - bx^2$ , then initial velocity of the particle is :
- (A)  $\sqrt{\frac{\alpha}{2b}}$                       (B)  $\sqrt{\frac{\alpha(1+a^2)}{2b}}$                       (C)  $\sqrt{\frac{\alpha}{a^2}}$                       (D)  $\sqrt{\frac{\alpha a^2}{b}}$
61. An object is projected in X-Y plane in which velocity changes according to relation  $\vec{V} = a\hat{i} + bx\hat{j}$ . Equation of path of particle is
- (A) Hyperbolic                      (B) Circular                      (C) Elliptical                      (D) Parabolic
62. A body is projected at angle of  $30^\circ$  and  $60^\circ$  with same velocity. Their horizontal ranges are  $R_1$  and  $R_2$  and maximum heights are  $H_1$  and  $H_2$  respectively then :
- (A)  $\frac{R_1}{R_2} > 1$                       (B)  $\frac{H_1}{H_2} > 1$                       (C)  $\frac{R_1}{R_2} < 1$                       (D)  $\frac{H_1}{H_2} < 1$

**SECTION – IV****Integer Answer Type**

This section contains 7 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y and Z (say) are 6, 0 and 9, respectively, then the correct darkening of bubbles will look like the following:

X	0	1	2	3	4	5	6	7	8	9
Y	0	1	2	3	4	5	6	7	8	9
Z	0	1	2	3	4	5	6	7	8	9

63. The relative density of a material is found by weighing the body first in air and then in water. If the weight in air is  $(10.0 \pm 0.1)$  gm and weight in water is  $(5.0 \pm 0.1)$  gm, then the maximum permissible percentage error in relative density is \_\_\_\_\_%.
64. A vernier calipers has 20 divisions on the vernier scale, which coincides with 19 on the main scale. The least count of the instrument is 0.1 mm. The value of one main scale division is \_\_\_\_\_ mm.
65. In the van-der Waal's equation,  $\left(P + \frac{an^2}{V}\right)(V - nb) = nRT$ , the error formed in P was 0.5%, error in V was 0.5% and error in n was 1%. What will be the error (in percentage) found in T, when R, a, b are constants?
66. While measuring acceleration due to gravity by simple pendulum, a student makes a positive error of 2% in the length of the pendulum and a positive error of 1% in the value of time period. His actual percentage error in the measurement of the value of g will be
67. If angle between  $\vec{a} = \hat{i} - \hat{j}$  and  $\vec{b} = \hat{i} + \hat{j}$  is  $x \frac{\pi}{4}$ , then find x
68. A body travelling along a straight line travelled one third of the total distance with a velocity 4 m/s. The remaining part of the distance was covered with a velocity 2 m/s for half the time and with velocity 6 m/s for the other half of time. Find the mean velocity averaged over the whole time of motion.
69. The acceleration time graph of a particle is shown in the figure. What is the velocity of particle at  $t = 8$ s, if initial velocity of particle is 3 m/s?



□ □