Competishun

52/6, Opposite Metro Mas Hospital, Shipra Path, Mansarovar

Date: 13/05/2024

Time: 3 hours **Max. Marks:** 180

PRAVEEN-2 (24-25)_ACT-1_PAPER-1

Physics

Multiple Choice Question

Q1 Which of the following statement(s) is/are false.

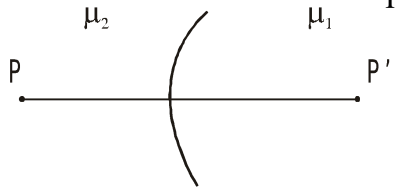
a) in vacuum the speed of red colour is more than that of violet light

b) an object in front of a spherical mirror is moved towards the pole from infinity. It is found that the image also moves towards the pole. The mirror must be convex

c) there exist two angles of deviation in a prism for which angle of incidence is the same

d) a ray travels from a rarer medium to denser medium. There exist two angles of incidence for which the deviation is the same

Q2 Two refracting media are separated by a spherical interface as shown in figure. PP' is the principle axis. μ_1 and μ_2 are the refractive indices of medium of incidence and medium of refraction respectively. Then:



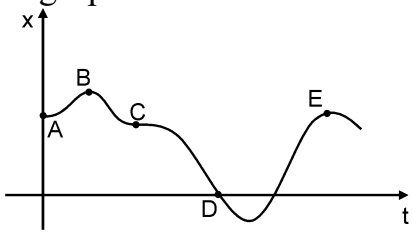
a) If $\mu_2 > \mu_1$ then there cannot be a real image of real object

b) If $\mu_2 > \mu_1$ then there cannot be a real image of virtual object

c) If $\mu_1 > \mu_2$ then there cannot be a virtual image of virtual object

d) If $\mu_1 > \mu_2$ then there cannot be a real image of real object

Q3 A graph of x verses 't' is shown in figure. Choose correct alternatives given below.



a) At E, the acceleration a < 0

b) At B, the acceleration a > 0

c) Average velocity between A and D is negative

d) The speed at 'D' is more than that of at 'E'

Q4 A small air bubble is trapped inside a transparent cube of size 12 cm. When viewed from one of the vertical faces, the bubble appears to be at 5 cm from it. When viewed from opposite face, it appears at 3 cm from it.

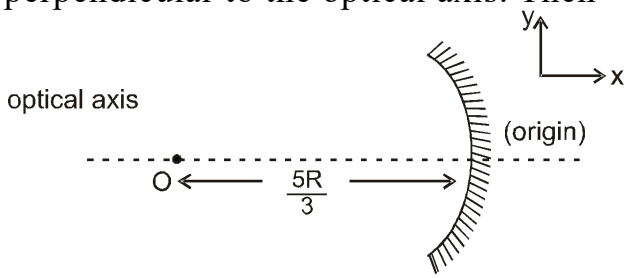
a) The distance of the air bubble from the first face is 7.5 cm.

b) The distance of the air bubble from the first face is 9 cm.

c) Refractive index of the material of the cube is 2.0.

d) Refractive index of the material of the cube is 1.5.

Q5 A point object is placed at a distance of $\frac{5R}{3}$ from the pole of concave mirror of small aperature and radius of curvature R. Point object oscillates with amplitude 1mm perpendicular to the optical axis. Then



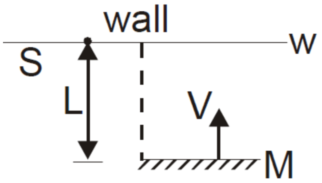
a) amplitude of image is $\frac{3}{7}$mm.

b) phase difference between motion of object and its image when object crosses optical axis is π.

c) position of image of object from pole is $\left(-\frac{5R}{7},0\right)$, when object at 'O'.

d) Image of object is real.

Q6 A flat mirror M is arranged parallel to a wall W at a distance L from it as shown in the figure. The light produced by a point source S kept on the wall is reflected by the mirror and produces a light patch on the wall. The mirror moves with velocity v towards the wall.



a) The patch of light will move with the speed v on the wall.

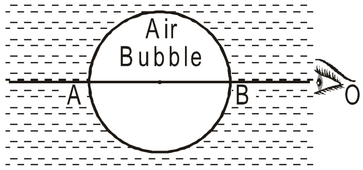
b) The patch of light will not move on the wall.

c) As the mirror comes closer the patch of light will become larger and shift away from the wall with speed larger than v.

d) The width of the light patch on the wall remains the same.

Numerical

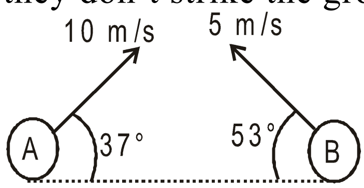
Q7 Inside water $\left(\mu = \frac{4}{3}\right)$ there is an air bubble of radius 4 cm as shown in figure. An observer O is looking into the diametrical axis AB of bubble. Find the distance in mm of a point object from point A on the axis in water which appears to be at point A as seen by observer.



Q8 Two plane mirrors are placed with reflecting surfaces parallel and facing to each other. A point object is placed between them at a distance 5cm from first mirror and 3 cm from second mirror. Find the distance (in cm) between the 3rd image behind first mirror and the 3rd image behind the second mirror.

Q9 A projectile is thrown horizontally from top of a tower of height 20 m with a velocity 10 m/sec. It strikes the smooth ground whose co-efficient of restitution is 0.5. The time elapsed (in seconds) after projection when it strikes the ground 2^{nd} time will be (neglect friction): [g = 10 m/s_2]

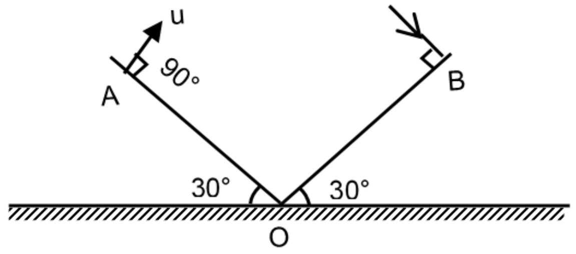
Q10 Two stones are in the same horizontal line and are $50\sqrt{5}$ m away. They are projected with a velocity of 10 m/s and 5 m/s respectively and with an angle of 37° and 53° with horizontal respectively. Find the minimum distance between them in meters. Suppose they don't strike the ground during the motion. (take g = 10)



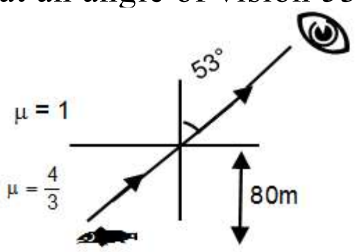
Q11 A ship is moving in a sea with a constant velocity of 50 m/s and a helicopter is flying horizontally with a constant velocity of 150 m/s in the same direction at 2 km height. Motion of the helicopter and the ship are in same vertical plane. When the helicopter is x km behind the ship horizontally, a packet is dropped from the helicopter so that it can reach the ship. Find the value of 10 x. (Neglect air resistance, take g = 10 m/s^2)

Q12 Consider a particle initially moving with a velocity 7 m/s starts decelerating at a constant rate of 2 m/s^2. The distance travelled in the fourth second is $\frac{x}{40}$ m. Find the value of x.

Q13 If the projectile projected from point A with initial speed 'u' as shown, it strikes the plane OB at point B normally. If OA = OB = 20m, find 'u' (m/s)



Q14 Find the apparent depth of a fish (in meters) whose real depth is 80 m and is observed at an angle of vision 53° as shown in the figure



Single Choice Question

Q15 A particle moves with an initial velocity V_0 and retardation αv, where α is a constant and v is the velocity at any time t.
After how much time, speed of particle decreases by 75%

a) $\frac{2\ell n2}{\alpha}$ **b)** $\frac{\ell n(4/3)}{\alpha}$ **c)** $\frac{3V_0}{4\alpha}$ **d)** $\frac{e^4}{\alpha}$

Q16 A particle moves with an initial velocity V_0 and retardation αv, where α is a constant and v is the velocity at any time t.
Total distance covered by the particle is

a) $\frac{v_0}{2\alpha}$ **b)** $\frac{v_0}{\alpha}$ **c)** $\frac{3v_0}{2\alpha}$ **d)** None of these

Q17 Magnification (by a lens) of an object at distance 10 cm from it is – 2. Now a second lens is placed exactly at the same position where first was kept and first lens is removed. The magnification by this lens is –3
Find position of image formed by combination of both in contact. (relative to combination) :

a) $\frac{60}{9}$ cm b) $\frac{60}{11}$ cm c) $\frac{60}{13}$ cm d) $\frac{60}{17}$ cm

Q18 Magnification (by a lens) of an object at distance 10 cm from it is – 2. Now a second lens is placed exactly at the same position where first was kept and first lens is removed. The magnification by this lens is –3
What is the focal length of the combination when both lenses are in contact :

a) $\frac{60}{17}$ cm b) $\frac{5}{17}$ cm c) $\frac{12}{7}$ cm d) $\frac{13}{9}$ cm

Chemistry

Multiple Choice Question

Q19 Which of the following statements is/are correct for mononuclear isoelectronic species :

a) They have same number of electrons. **b)** They have different number of protons.

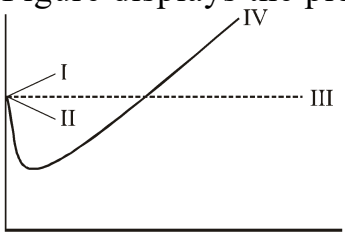
c) Their ionic radii decreases with increase in nuclear charge.

d) They have same ionic radii due to same number of filled shells.

Q20 Which of the following represent the correct order of electron affinities ?

a) F > Cl > Br > I **b)** C < N < O < F **c)** N < C < O < F **d)** Cl > F > Br > I

Q21 Figure displays the plot of the compression factor Z verses p for a few gases



Which of the following statements is/are correct for a van-der waals gas :

a) The plot I is applicable provided the vander waals constant a is negligible

b) The plot II is applicable provided the vander waals constant b is negligible

c) The plot III is applicable provided the vander waals constants a and b are negligible

d) The plot IV is applicable provided the temperature of the gas is much higher than its critical temperature

Q22 Choose the correct statement(s) :

a) The shape of an atomic orbital depends upon azimuthal quantum number

b) The orientation of an atomic orbital depends upon the magnetic quantum number

c) The energy of an electron in an atomic orbital of multi-electron atom depends upon principal quantum number only

d) The number of degenerate atomic orbitals of one type depends upon the value of azimuthal quantum number

Q23 Poor shielding of nuclear charge by d or f – orbital electrons is responsible for which of the following facts :

a) Atomic radius of Nb (4–d series) is comparable to that of Ta (5–d series)

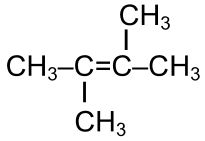
b) The Ist ionisation energy of cxopper is less than that of Zinc

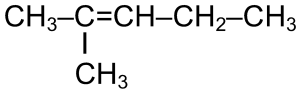
c) Atomic radius of Al and Ga are nearly same.

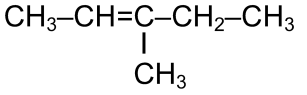
d) The Ist ionisation energy for Au is greater than that of Ag.

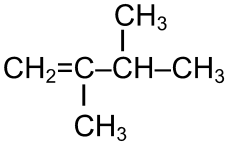
Q24 (A) C_6H_{12} (Acyclic) $\xrightarrow[\text{hydrogenation}]{\text{Catalytic}}$ C_6H_{14} (Acyclic) $\xrightarrow[h\nu]{Cl_2}$ Two monochlorinated structural product

The structure of compound (A) may be

a) 

b) 

c) 

d) 

Numerical

Q25 Calculate molecular diameter for a gas if its molar excluded volume is 3.2 π ml. (in nenometer). Give the answer by multiplying with 100. (Take $N_A = 6.0 \times 10^{23}$)

Q26 0.2 mol HCl and 0.2 mol of $BaCl_2$ were dissolved in 500 mL of 0.1 M solution of NH_4Cl. The 10 times of the Molarity of Cl^- ion is: (Assume volume of solution remains same)

Q27 The atomic ratio of H^1 to H^3 in a sample of water is $1 : 8 \times 10^{-8}$. How many H^3 atoms are present in 9.0 g of such water sample? (Answer in the order 10^{15}) ($N_A = 6 \times 10^{23}$)

Q28 If wave functions, $\Psi(r, \theta, \phi)$ of 2s and $2p_z$ electrons in a hydrogen atom are given by

$\Psi(2s) = K_1 \left(2 - \frac{r}{a_0}\right) e^{-r/a_0}$ and

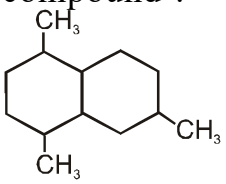
$\Psi(2p_z) = k_2 \left(\frac{r}{a_0}\right) e^{-r/a_0} cos\theta$,

where a_0 = 53 pm and let constants $k_1 = k_2$. If the probability of finding the electron in 2s orbital in a small spherical volume of radius r_0 ($r_0 << a_0$) around $r = a_0$ is P_1 and of electron in $2p_z$ orbital in same spherical volume around $r = a_0$ at $\theta = 30^0$ is P_2 then Find $(P_1 - P_2) \times 15$:

Q29 Find the number of electron in chromium $(_{24}Cr)$ which have orbital angular momentum equal to $\frac{h}{\sqrt{2}\pi}$.

Q30 The number of electrons having $l = 0$ in chlorine atom (Z = 17) is

Q31 How many products (structural isomers) are formed by monochlorination of following compound ?



Q32 How many alkene on hydrogenation give 2,3-dimethyl pentane ?

Single Choice Question

Q33 Molarity, molality, mole fraction are used in these days for stoichiometric calculations. It is necessary to write balanced chemical equation when calculations are done in terms of molarity.

38% HCl has density equal to 1.20 g ml^{-1}. The molality and molarity respectively are

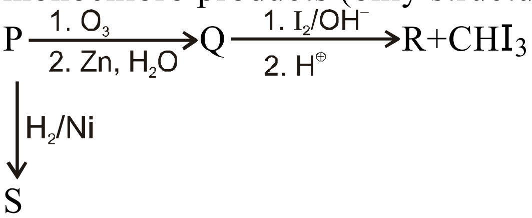
a) 12.4, 16.7 **b)** 16.7, 12.4 **c)** 12.4, 12.2 **d)** 16.7, 16.7

Q34 Molarity, molality, mole fraction are used in these days for stoichiometric calculations. It is necessary to write balanced chemical equation when calculations are done in terms of molarity.

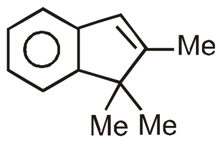
Mole fraction of solute in aqueous solution is 0.2. The molarity of solution will be -

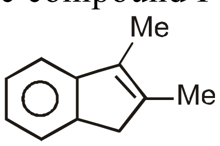
a) 13.88 **b)** 1.388 **c)** 0.138 **d)** 0.0138

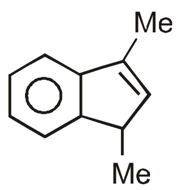
Q35 (Q) gives positive iodoform test and also give red precipitate with fehling solution. Hydrogenation of (P) results benzenoid compound (S). Compound (S) gives three monochloro products (only structural) on monochlorination.

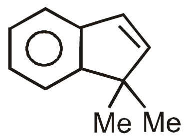


The structure of the aromatic compound P is :

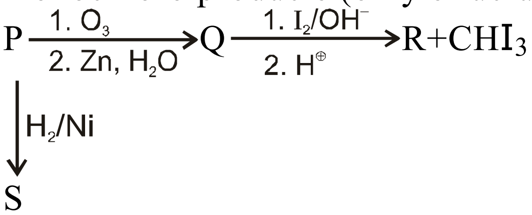
a) 

b) 

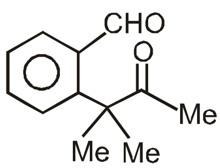
c) 

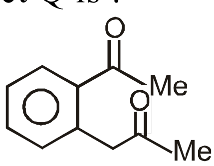
d) 

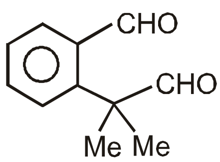
Q36 (Q) gives positive iodoform test and also give red precipitate with fehling solution. Hydrogenation of (P) results benzenoid compound (S). Compound (S) gives three monochloro products (only structural) on monochlorination.

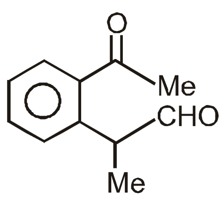


The structure of the product Q is :

a) 

b) 

c) 

d) 

Mathematics

Multiple Choice Question

Q37 If $\sec^2\theta$ & $\text{cosec}^2\theta$ are roots of $ax^2 + bx + c = 0$ $(a > 0)$ then

a) $b + c = 0$ **b)** $b^2 - 4ac \geq 0$ **c)** $c \geq 4a$ **d)** $b + 4a \geq 0$

Q38 If quadratic equation $ax^2 + bx - (a^2 + b^2 + c^2 - ab - bc - ac) = 0$ (where a, b, c are distinct real numbers) has imaginary root then

a) $(a - b)^2 + (b - c)^2 + (c - a)^2 - 2(a + b) > 0$

b) $(a - b)^2 + (b - c)^2 + (c - a)^2 - 2(a + b) < 0$

c) $(a - b)^2 + (b - c)^2 + (c - a)^2 - 2(a - b) < 0$

d) $(a - b)^2 + (b - c)^2 + (c - a)^2 - 2(a - b) > 0$

Q39 If each root of $x^2 - ax - b = 0$, $a, b \in R$ has absolute value less than 1, then which of the following statements is/are true ?

a) $|b| < 1$ **b)** $a + b < 1$ **c)** $b - a < 1$ **d)** $a - b < 1$

Q40 The possible values of 'a' for which $e^{2x} - (a - 2)\, e^x + a < 0$ holds for at least one $x \in (0, \infty)$ are

a) 6 **b)** 9 **c)** 12 **d)** 16

Q41 Let S is the set of all real x such that $\frac{2x-1}{2x^3+3x^2+x}$ is positive, then S contains :

a) $\left(-\infty, -\frac{3}{2}\right)$ **b)** $\left(-\frac{3}{2}, -\frac{1}{2}\right)$ **c)** $\left(-\frac{1}{2}, 0\right)$ **d)** $\left(\frac{1}{2}, 2\right)$

Q42 If $kx^2 - 4x + 3k + 1 > 0$ for atleast one $x > 0$, then if $k \in S$, then S contains:

a) $(1, \infty)$ **b)** $(0, \infty)$ **c)** $(-1, \infty)$ **d)** $\left(-\frac{1}{4}, \infty\right)$

Numerical

Q43 Let α and β be the roots of the quadratic equation $x^2 - 6x + 4 = 0$ and $A_n = \alpha^n + \beta^n$ then value of $\frac{A_{50}(A_{48}+A_{49})-6A_{49}^2+4A_{48}^2}{A_{48}A_{49}}$ is

Q44 The number of positive integers satisfying the equation $x + \log_{10}(2^x + 1) = x\log_{10}5 + \log_{10}6$ is

Q45 The no. of solutions of equation $\log_6(x + 3) = 7 - x$ is-

Q46 The number of solution of $\log_2 (x - 1) = 2 \log_2 (x - 3)$ is :

Q47 Find the number of integral values of x in $[-\pi, \pi]$ which satisfies the domain of f(x) $= \sqrt{\log_2\{4\sin^2 x - 2\sqrt{3}\sin x - 2\sin x + \sqrt{3} + 1\}}$

Q48 Find number of solution of Sgn$(x^3 - x) = |x| - 1$ (Where Sgn (.) is Signum function)

Q49 Find the number of integral values of 'm' less than 50, so that the roots of the quadratic equation $mx^2 + (2m - 1)x + (m - 2) = 0$ are rational

Q50 Polynomial P(x) contains only terms of odd degree. When P(x) is divided by (x – 3), then remainder is 6. If P(x) is divided by $(x^2 - 9)$ then remainder is g(x). Find the value of g(2).

Single Choice Question

Q51 $f : R \rightarrow R$, f(x) = $\begin{cases} 2 - x, & x \le 1 \\ 2x - x^2, & x > 1 \end{cases}$, g(x) is inverse of f(x). Number of roots of f(x) = g(x) is equal to 'a', The expression $h(x) = ax^2 + bx + c$, where a is as above, f(b) = 0 and c is the greatest integer for which f(x) > 0

Value of a is less than

a) 1 **b)** 2 **c)** 3 **d)** 4

Q52 $f : R \rightarrow R$, f(x) = $\begin{cases} 2 - x, & x \le 1 \\ 2x - x^2, & x > 1 \end{cases}$, g(x) is inverse of f(x). Number of roots of f(x) = g(x) is equal to 'a', The expression $h(x) = ax^2 + bx + c$, where a is as above, f(b) = 0 and c is the greatest integer for which f(x) > 0

Minimum value of h(x) is

a) $\frac{2}{3}$ **b)** $\frac{1}{3}$ **c)** 0 **d)** 1

Q53 Let $f(x) = x^2 + b_1x + c_1$, $g(x) = x^2 + b_2x + c_2$, real roots of f(x) = 0 be α, β and real roots of g(x) = 0 be $\alpha + \delta, \beta + \delta$. Also assume that the least value of f(x) be $-\frac{1}{4}$ and the least value of g(x) occurs at $x = \frac{7}{2}$

The least value of g(x) is

a) –1 **b)** – 1/2 **c)** –1/4 **d)** –1/3

Q54 Let $f(x) = x^2 + b_1x + c_1$, $g(x) = x^2 + b_2x + c_2$, real roots of f(x) = 0 be α, β and real roots of g(x) = 0 be $\alpha + \delta, \beta + \delta$. Also assume that the least value of f(x) be $-\frac{1}{4}$ and the least value of g(x) occurs at $x = \frac{7}{2}$

The value of b_2 is

a) 6 **b)** –7 **c)** 8 **d)** 0

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**A, C, D**	**A, C**	**A, C, D**	**A, D**	**A, C, D**	**B, D**	**80**	**48**	**04**	**20**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**20**	**20**	**20**	**45**	**A**	**B**	**B**	**A**	**A, B, C**	**C, D**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**A, B, C**	**A, B, D**	**A, C, D**	**A, D**	**20**	**13**	**48**	**15**	**12**	**06**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**13**	**05**	**B**	**A**	**C**	**D**	**A, B, C**	**A, D**	**A, B, C**	**B, C, D**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**A, C, D**	**A, B, D**	**02**	**01**	**01**	**01**	**06**	**03**	**06**	**4**
Que.	51	52	53	54						
Ans.	**D**	**A**	**C**	**B**						