

**PHYSICS**

Q.1 Which one of the following represent the correct dimensions of the coefficient of viscosity?

- (a)  $ML^{-1}T^{-2}$   
 (b)  $MLT^{-1}$   
 (c)  $ML^{-1}T^{-1}$   
 (d)  $ML^{-2}T^{-2}$

Ans. (c)

Q.2 A student uses a simple pendulum of exactly 1 m length to determine  $g$ , the acceleration due to gravity. He uses a stop watch with the least count of 1 sec for this and records 40 seconds for 20 oscillations. For this observation, which of the following statements is true?

- (a) Error  $\Delta T$  in measuring  $T$ , the time period, is 0.15 seconds.  
 (b) Error  $\Delta T$  in measuring  $T$ , the time period, is 1 second.  
 (c) Percentage error in the determination of  $g$  is 5%.  
 (d) Percentage error in the determination of  $g$  is 2.5%

Ans. (c)

Q.3 An object moving with a speed of  $6.25 \text{ m s}^{-1}$ , is decelerated at a rate given by  $\frac{dv}{dt} = -2.5\sqrt{v}$ , where  $v$  is the

instantaneous speed. This time taken by the object, to come to rest would be-

- (a) 1 s  
 (b) 2 s  
 (c) 4 s  
 (d) 8 s

Ans. (b)

Q.4 A car moving with a speed of 50 km/h can be stopped by brakes after at least 6m. If the same car is moving at the speed of 100km/h, the minimum stopping distance is

- (a) 12 m  
 (b) 18 m  
 (c) 24 m  
 (d) 6 m

Ans. (c)

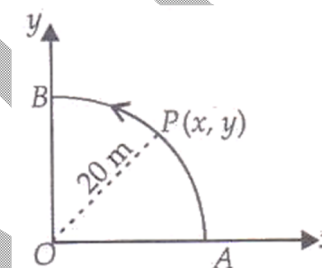
Q.5 From a tower of height  $H$ , a particle is thrown vertically upwards with a speed  $u$ . The time taken by the particle, to hit the ground, is  $n$  times that taken by it to reach the highest point of its path. The relation between  $H, u$  and  $n$  is :-

- (a)  $gH = (n - 2)u^2$   
 (b)  $2gH = n^2u^2$   
 (c)  $gH = (n - 2)^2u^2$   
 (d)  $2gH = nu^2(n - 2)$

Ans. (d)

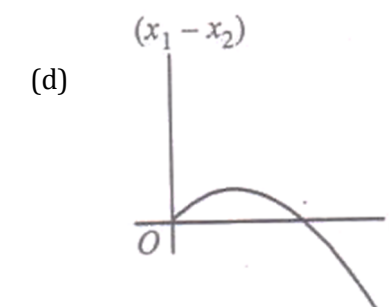
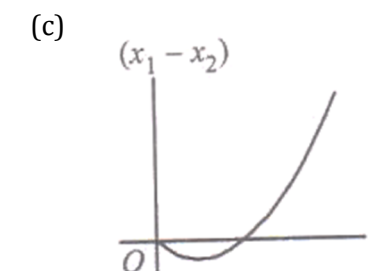
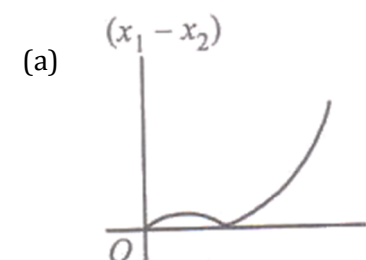
Q.6 A point  $P$  moves in counter-clockwise direction on a circular path as shown in the figure. The movement of  $P$  is such that it sweeps out a length  $s = t^3 + 5$ , where  $s$  is in metres and  $t$  is in seconds. The radius of path is 20 m. The acceleration of  $P$  when  $t = 2$  s is nearly

- (a)  $14 \text{ m s}^{-2}$   
 (b)  $13 \text{ m s}^{-2}$   
 (c)  $12 \text{ m s}^{-2}$   
 (d)  $7.2 \text{ m s}^{-2}$



Ans. (a)

Q.7 A body is at rest at  $x = 0$ . At  $t = 0$ , it starts moving in the positive  $x$ -direction with a constant acceleration. At the same instant another body passes through  $x = 0$  moving in the positive  $x$ -direction with a constant speed. The position of the first body is given by  $x_1(t)$  after time  $t$  and that of the second body by  $x_2(t)$  after the same time interval. which of the following graphs correctly describes  $(x_1 - x_2)$  as a function of time  $t$ ?



Ans. (c)

Q.8 A particle is moving eastwards with a velocity of  $5 \text{ m/s}$ . In 10s the velocity changes to  $5 \text{ m/s}$  northwards. The average acceleration in this time is

- (a) Zero  
 (b)  $\frac{1}{\sqrt{2}} \text{ m s}^{-2}$  towards north-west  
 (c)  $\frac{1}{\sqrt{2}} \text{ m s}^{-2}$  towards north-east  
 (d)  $\frac{1}{2} \text{ m s}^{-2}$  towards north

Ans. (b)

Q.9 Which of the following statements is false for a particle moving in a circle with a constant angular speed?

- (a) The velocity vector is tangent to the circle
- (b) The acceleration vector is tangent to the circle
- (c) The acceleration vector points to the centre of the circle
- (d) The velocity and acceleration vectors are perpendicular to each other

**Ans. (b)**

Q.10 A person start his journey at 9:00 am from Nahan to Chandigarh. Its position varies w.r.t. time as  $s = \alpha t^2$ . It crosses Kala-amb at 9:20 am. What will be its velocity and distance at 9:20 am ( $\alpha = 0.02 \text{ m/s}^2$ ).

- (a) 28.8 m/s, 48 km
- (b) 48 m/s, 28.8 km
- (c) 28.8 m/s, 28.8 km
- (d) 48 m/s, 48 km.

**Ans. (b)**

Q.11 The relation between time  $t$  and distance  $x$  is  $t = ax^2 + bx$  where  $a$  and  $b$  are constants. The acceleration is

- (a)  $-2av^3$
- (b)  $2av^2$
- (c)  $-2av^2$
- (d)  $2bv^3$

**Ans. (a)**

Q.12 A ball of mass (m) 0.5kg is attached to the end of a string having length (L) 0.5 m. The ball is rotated on a horizontal circular path about vertical axis. The maximum tension that the string can

bear is 324 N. The maximum possible value of angular velocity of ball (in radian/s) is

- (a) 9
- (b) 18
- (c) 27
- (d) 36

**Ans. (d)**

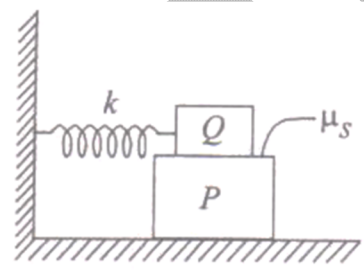
Q.13 A block  $P$  of mass  $m$  is placed on a horizontal frictionless plane. A second block of same mass  $m$  is placed on it and is connected to a spring of spring constant  $k$ . The two blocks are pulled by distance  $A$ . Block  $Q$  oscillates without slipping. What is the maximum value of frictional force between the two blocks?

- (a)  $kA/2$
- (b)  $kA$
- (c)  $\mu_s mg$
- (d) zero

**Ans. (a)**

Q.14 A force  $\vec{F} = (5\hat{i} + 3\hat{j} + 2\hat{k})N$  is applied over a particle which displaces it from its origin to the point  $\vec{r} = (2\hat{i} - \hat{j})m$ . The work done on the particle in joule is-

- (a) -7
- (b) +7
- (c) +10
- (d) +13

**Ans. (b)**

Q.15 A particle of mass 100 g is thrown vertically upwards with a speed of  $5\text{m/s}$ .

The work done by the force of gravity during the time the particle goes up is

- (a) 0.5 J
- (b) -0.5 J
- (c) -1.25 J
- (d) 1.25 J

**Ans. (c)**

## CHEMISTRY

Q.16 The equivalent weight of an element is 4. Its chloride has a vapour density 59.25.

Then the valency of the element is

- (a) 4
- (b) 3
- (c) 2
- (d) 1

**Ans. (b)**

Q.17  $6.02 \times 10^{20}$  molecules of urea are present in 100 mL of its solution. The concentration of solution is

- (a) 0.02
- (b) 0.01
- (c) 0.001
- (d) 0.1

**Ans. (b)**

Q.18 The energies  $E_1$  and  $E_2$  of two radiations are 25 eV, and 50eV, respectively. The relation between their wavelengths, i.e.  $\lambda_1$  and  $\lambda_2$  will be

- (a)  $\lambda_1 = \frac{1}{2}\lambda_2$
- (b)  $\lambda_1 = \lambda_2$
- (c)  $\lambda_1 = 2\lambda_2$
- (d)  $\lambda_1 = 4\lambda_2$ .

**Ans. (c)**

Q.19 The total number of nodes are given by

- (a)  $(n + 1)$
- (b)  $(n - l - 1)$
- (c)  $(n - 1)$
- (d)  $(n - l + 1)$

**Ans. (b)**

Q.20 The first ionisation potential of Na is 5.1 eV. The value of electron gain enthalpy of  $Na^+$  will be

- (a) -2.55 eV
- (b) - 5.1 eV
- (c) -10.2 eV
- (d) +2.55 eV.

**Ans. (b)**

Q.21 Match the Column I with Column II and select the correct answer using given codes.

Column I (Elements)	Column II (Properties)
A. $Li^+ < Al^{3+} < Mg^{2+} < K^+$	1. EA (Electron affinity)
B. $Li^+ > Al^{3+} >$	2. Ionic radii

$Mg^{2+} > K^+$	
C. $Cl > F > Br > I$	3. EN (Electronegativity)
D. $F > Cl > Br > I$	4. ENC (Effective nuclear charge)

## Codes

	A	B	C	D
(a)	2	4	3	1
(b)	2	4	1	3
(c)	4	2	3	1
(d)	4	2	1	3

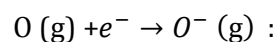
Ans. (b)

Q.22 The electronic configuration of gadolinium (atomic number = 64) is

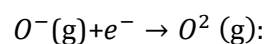
- (a)  $[Xe] 4f^3 5d^5 6s^2$   
 (b)  $[Xe] 4f^7 5d^2 6s^1$   
 (c)  $[Xe] 4f^7 5d^1 6s^2$   
 (d)  $[Xe] 4f^8 5d^6 6s^2$

Ans. (c)

Q.23 The formation of oxide ion  $O^{2-}(g)$ , from oxygen atom requires first an exothermic and then an endothermic step as shown below.



$$\Delta H^- = -141 \text{ kJ mol}^{-1}$$



$$\Delta H^- = +780 \text{ kJ mol}^{-1}$$

Thus, process of formation of  $O^{2-}$  in gas phase is unfavorable even though  $O^{2-}$  is isoelectronic with neon. It is due to the fact that

- (a) Oxygen is more electronegative

(b) Addition of electron in oxygen results in larger size of the ion

(c) Electron repulsion out weights the stability gained by achieving noble gas configuration

(d)  $O^-$  ion has comparatively smaller size than O-atom

Ans. (c)

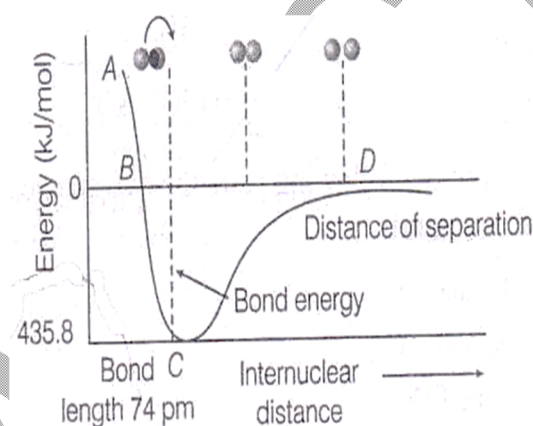
Q.24 Isostructural species are those which have the same shape and hybridisation.

Among the given species identify the isostructural pairs

- (a)  $[NF_3 \text{ and } BF_3]$   
 (b)  $[BF_4^- \text{ and } NH_4^+]$   
 (c)  $[BCl_3 \text{ and } BrCl_3]$   
 (d)  $[NH_3 \text{ and } NO_3^-]$

Ans. (b)

Q.25



The above potential energy curve is given for the formation of  $H_2$  molecules as a function of internuclear distance of H-atoms. At what point in the curve  $H_2$  is found in the most stable state?

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

(d) D

Ans. (c)

Q.26 If  $Z$  is a compressibility factor, van der Waals' equation at low pressure can be written as

- (a)  $Z = 1 + \frac{RT}{pb}$   
 (b)  $Z = 1 - \frac{a}{VRT}$   
 (c)  $Z = 1 - \frac{pb}{RT}$   
 (d)  $Z = 1 + \frac{pb}{RT}$

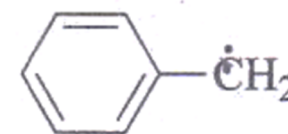
Ans. (b)

Q.27 Which of the following set of variable gives a straight line with a negative slope when plotted? ( $p$  = vapour pressure and  $T$  = Temperature in Kelvin)

- |     | y-axis        | x-axis                  |
|-----|---------------|-------------------------|
| (a) | $p$           | $T$                     |
| (b) | $\log_{10} P$ | $T$                     |
| (c) | $\log_{10} P$ | $\frac{1}{T}$           |
| (d) | $\log_{10} P$ | $\log_{10} \frac{1}{T}$ |

Ans. (c)

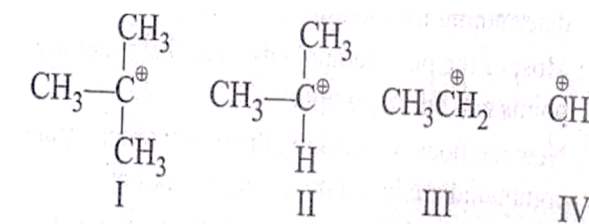
Q.28 The radical is aromatic because it has



- (a)  $6p$ - orbitals and 6 unpaired electrons  
 (b)  $7p$ - orbitals and 6 unpaired electrons  
 (c)  $7p$ - orbitals and 7 unpaired electrons  
 (d)  $6p$ - orbitals and 7 unpaired electrons

Ans. (c)

Q.29 Choose the correct order of stability of carbocation using the concept of hyperconjugation



- (a)  $I < II < III < IV$   
 (b)  $IV < III < II < I$   
 (c)  $III < IV < II < I$   
 (d) None of these

Ans. (b)

Q.30 Which of the following compounds will exhibit geometrical isomerism?

- (a) 1-phenyl-2-butene  
 (b) 3-phenyl-1-butene  
 (c) 2-phenyl-1-butene  
 (d) 1, 1-diphenyl-1-propane

Ans. (a)

## MATHEMATICS

Q.31 If  $f(x) = \ln \left( \frac{1+x}{1-x} \right)$ , then  $f \left( \frac{2x}{1+x^2} \right) =$

- (a)  $f(x)$   
 (b)  $f \left( \frac{1}{x} \right)$   
 (c)  $2f(x)$   
 (d)  $2f \left( \frac{1}{x} \right)$

Ans. (c)

Q.32 The number of roots of the equation

$$\sin x = 3 \cos 2x - 1 \text{ in } [-\pi, \pi] \text{ is}$$

- (a) 1
- (b) 2
- (c) 3
- (d) 4

**Ans. (d)**

Q.33 For all complex numbers  $z_1$  and  $z_2$  satisfying

$$|z_1| = 12 \text{ and } |z_2 - 3 - 4i| = 5 \text{ then minimum value of } |z_1 - z_2| \text{ is}$$

- (a) 0
- (b) 2
- (c) 7
- (d) 17

**Ans. (b)**

Q.34 If  $\alpha, \beta, \gamma$  are the roots of the equation

$$x^3 + 27 = 0 \text{ then the quadratic whose}$$

roots are  $\left(\frac{\gamma}{\alpha}\right)^2$  and  $\left(\frac{\beta}{\alpha}\right)^2$  is

- (a)  $x^2 + x - 1 = 0$
- (b)  $x^2 + 3x + 9 = 0$
- (c)  $x^2 + x + 1 = 0$
- (d)  $x^2 - x + 1 = 0$

**Ans. (c)**

Q.35 If the minimum value

$f(x) = x^2 + 2bx + 2c^2$  is greater than the maximum value of

$$g(x) = -x^2 - 2cx + b^2 \text{ then}$$

- (a)  $|b| < 2|c|$
- (b)  $|c| < 2|b|$
- (c)  $|c| > \sqrt{2}|b|$
- (d)  $|b| > \sqrt{2}|c|$

**Ans. (c)**

Q.36 A father with 8 children, takes 3 at a time to zoo as often as he can without taking the same children together more than once. The number of times he visits zoo is a and the number of times each child visit visits zoo is b. Then  $a + b =$

- (a) 55
- (b) 66
- (c) 77
- (d) 88

**Ans. (c)**

Q.37 The number of words formed with the letters of word CAREERACADEMY without changing the order of the vowels and consonants is

- (a) 25100
- (b) 25200
- (c) 25300
- (d) None

**Ans. (b)**

Q.38 The coefficient of  $x^9$  in the expansion of

$$(1 + x + x^2 + x^3)^3(1 - x)^6 \text{ is}$$

- (a) -7
- (b) 7
- (c) 9
- (d) -9

**Ans. (d)**

Q.39 The number of irrational terms in the expansion of  $(\sqrt[8]{5} + \sqrt[6]{2})^{100}$  is

- (a) 97

(b) 98

(c) 96

(d) 99

**Ans. (a)**

Q.40 If  $a_1, a_2, \dots, a_n$  are in A.P. where  $a_i > 0$  for all  $i$  then

$$\frac{1}{\sqrt{a_1} + \sqrt{a_2}} + \frac{1}{\sqrt{a_2} + \sqrt{a_3}} + \dots + \frac{1}{\sqrt{a_{n-1}} + \sqrt{a_n}} =$$

(a)  $\frac{1}{\sqrt{a_1} + \sqrt{a_n}}$

(b)  $\frac{n}{\sqrt{a_1} + \sqrt{a_n}}$

(c)  $\frac{n+1}{\sqrt{a_1} + \sqrt{a_n}}$

(d)  $\frac{n-1}{\sqrt{a_1} + \sqrt{a_n}}$

**Ans. (d)**

Q.41 Let  $\alpha, \beta$  be the roots of  $x^2 - x + p = 0$  and  $\gamma, \delta$  be the roots of  $x^2 - 4x + q = 0$ . If  $\alpha, \beta, \gamma, \delta$  are in G.P. then the integral values of p and q respectively are

- (a) -2, -36
- (b) -2, 3
- (c) -2, -32
- (d) None

**Ans. (c)**

Q.42 For all values of a and b the lines

$$(a + 2b)x + (a - b)y + a + 5b = 0$$

pass through the point

- (a) (-1, 2)
- (b) (2, -1)

(c) (-2, 1)

(d) (1, -2)

**Ans. (c)**

Q.43 The image of the point (2,5) with respect to the line  $3x + 4y - 1 = 0$  is

- (a) (-4, -3)
- (b) (-3, -4)
- (c) (4, 3)
- (d) None

**Ans. (a)**

Q.44 Two vertices of a triangle ABC are  $A(5, -1)$  and  $B(-2, 3)$ . If the orthocentre is the origin then the vertex C is

- (a) (4,7)
- (b) (-4,7)
- (c) (4, -7)
- (d) (-4, -7)

**Ans. (d)**

Q.45 In career Academy Sr. Sec. School 60 students of class 12th get above 90% marks in board exam. 30 % students gets between 80% to 90% marks and remaining 150 students passed below 80% marks.

Then what is the % of students getting above 90% marks

- (a) 10%
- (b) 20%
- (c) 30%
- (d) None

**Ans. (b)**