Medicine Paper 2 - Chapter 3 and 4

1. A block of mass M placed on a frictionless horizontal table is pulled by an other block of mass m hanging vertically by a massless string passing over a frictionless pulley. The tension in the string is

(a) $\frac{m}{M+m}g$

(b) $\frac{M}{M+m}g$

(c) $\frac{M+m}{Mm}g$

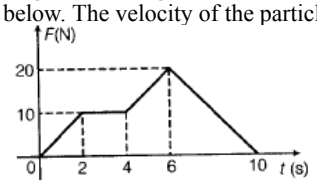
(d) $\frac{Mm}{M+m}g$

Answer: d
Solution

$$T = \frac{m_1 m_2}{m_1 + m_2} g$$

$$\therefore Tension = \frac{Mm}{M+m} g$$

2. A particle of mass 2 kg is initially at rest. A force acts on it whose magnitude changes with the time. The force-time graph is shown below. The velocity of the particle after 10 s is



(a) 20 ms^{-1}
(b) 10 ms^{-1}
(c) 75 ms^{-1}
(d) 26 ms^{-1}
(e) 50 ms^{-1}

Answer: e
Solution

Change in momentum=Area under F-t curve

$$\Rightarrow m(V-U) = \frac{1}{2}\times 2\times 10 + \frac{1}{2}(10+20)\times 2 + \frac{1}{2}\times 4\times 20$$

$$\Rightarrow 2(V-0) = 10+20+30+40$$

$$\Rightarrow 2V = 100$$

$$\Rightarrow V = 50\ m/s$$

3. An object is kept on a smooth inclined plane of 1 in *l*. The horizontal acceleration to be imparted to the inclined plane so that the object is stationary relative to the inclined is

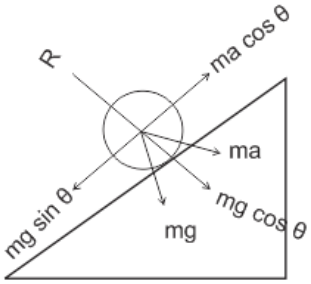
(a) $g\sqrt{l^2-1}$

(b) $g(l^2-1)$

(c) $\frac{g}{\sqrt{l^2-1}}$

(d) $\frac{g}{l^2-1}$

Answer: c
Solution

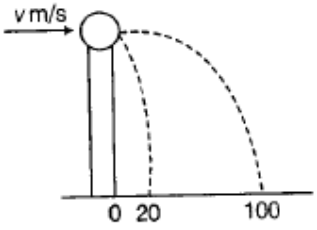


$$\therefore a = g\tan\theta$$

$$= g\left[\frac{opposite}{Adjacent}\right]$$

$$= g\frac{1}{\sqrt{l^2-1}}$$

4. A ball of mass 0.2 kg rests on a vertical post of height 5 m. A bullet of mass 0.01 kg, travelling with a velocity v m/s in a horizontal direction, hits the centre of the ball. After the collision, the ball and bullet travel independently. The ball hits the ground at a distance of 20m and the bullet at a distance of 100m from the foot of the post. The initial velocity v of the bullet is



(a) 250 m/s
(b) $250\sqrt{2}$ m/s
(c) 400 m/s
(d) 500 m/s

Answer: d
Solution

Time taken by bullet and ball to strike ground is t

$$t = \sqrt{\frac{2b}{g}}$$

$$= \sqrt{\frac{2\times 5}{10}} = 1\ s$$

$$x = Vt$$

$$\Rightarrow 20 = V_1 \times 1 \quad \Rightarrow V_1 = 20\ m/s$$

$$x = V_2 t$$

$$\Rightarrow 100 = V_2 \times 1$$

$$\Rightarrow V_2 = 100\ m/s$$

From conservation of linear momentum $0.01V = (0.02\times 20) + (0.01\times 100)$

$$\Rightarrow V = 500\ m/s$$

5. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 ms^{-1}. To give an initial upward acceleration of 20 ms^{-2}, the amount of gas ejected per second to supply the needed thrust will be (take,g =10 ms^{-2})

(a) 127.5 kgs^{-1}
(b) 187.5 kgs^{-1}
(c) 185.5 kgs^{-1}
(d) 137.5 kgs^{-1}

Answer: b
Solution

Thurst on rocket, $f_t = v_r\left(-\frac{d_m}{d_t}\right)$

$$f_{net} = f_t - w$$

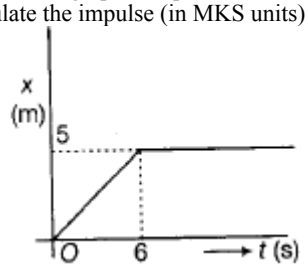
$$\Rightarrow ma = v_r\left(\frac{d_m}{d_g}\right) - mg$$

$$\Rightarrow \left(-\frac{dm}{dt}\right) = \frac{m(g+a)}{v_r}$$

Rate of gas ejected per second

$$= \frac{5000(10+20)}{800} = 187.5\ kg/s$$

6. The position – time graph of a particle of mass 4 kg is shown in the figure. Calculate the impulse (in MKS units) at time t= 0 and t= 6 s



respectively

(a) +6.31 and –6.31
(b) +3.33 and –3.33
(c) +5.25 and –5.25
(d) +3.25 and –3.25

Answer: b
Solution

From graph , at $t = 6S$

$$V = \frac{5}{6} m/s^2$$

$$Impulse = change\ in\ momentum$$

$$= m_1V_2 - m_2V_1$$

$$= 4 \times \frac{5}{6} - 4 \times 0 = 3.33$$

7. The potential energy as a function of the force between two atoms in a diatomic molecules is given by $U(x) = \frac{A}{x^{12}} - \frac{B}{x^6}$, where A and B are positive constants and x refers to the distance between atoms. The position of stable equilibrium for the system of the two atoms is g

(a) $x = \frac{A}{B}$

(b) $x = \sqrt{\frac{A}{B}}$

(c) $x = \frac{\sqrt{3A}}{B}$

(d) $x = \left(\frac{2A}{B}\right)^{\frac{1}{6}}$

Answer: d
Solution

$$u(x) = \frac{A}{x^{12}} - \frac{B}{x^6}$$

$$\frac{dv}{dx} = -12Ax^{-13} + 6Bx^{-7}$$

For stable equlibrium

$$F = 0$$

$$\Rightarrow -12Ax^{-13} + 6Bx^{-7} = 0$$

$$\Rightarrow \frac{x^{-7}}{x^{-13}} = \frac{12A}{6B}$$

$$\Rightarrow x^6 = \frac{2A}{B}$$

$$\Rightarrow x = \left(\frac{2A}{B}\right)^{\frac{1}{6}}$$

8. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly off in two mutually perpendicular directions, one with a velocity of $3\hat{i}\ ms^{-1}$ and the other with a velocity of $4\hat{j}\ ms^{-1}$. If the explosion occurs in $10^{-4}\ s$, the average force acting on the third piece in newton is

(a) $(3\hat{i} + 4\hat{j}) \times 10^{-4}$
(b) $(3\hat{i} - 4\hat{j}) \times 10^{-4}$
(c) $(3\hat{i} + 4\hat{j}) \times 10^{4}$
(d) $-(3\hat{i} + 4\hat{j}) \times 10^{4}$
(e) $(4\hat{i} + 3\hat{j}) \times 10^{4}$

Answer: d
Solution

By conservation of linear momentum

$$m_1v_1 + m_2v_2 + m_3v_3 = 0$$

$$\Rightarrow 1\times 3\hat{i} + 1\times 4\hat{j} + 1\times v_3 = 0$$

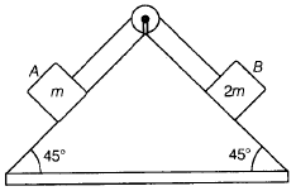
$$\Rightarrow 3\hat{i} + 4\hat{j} + v_3 = 0$$

Force on 3rd piece, $F = \frac{mv_3}{t}$

$$\Rightarrow F = 1 \times (-3\hat{i} - 4\hat{j})/10^{-4}$$

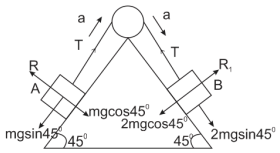
$$= -(3\hat{i} + 4\hat{j}) \times 10^4 N$$

9. Block A of mass m and block B of mass 2m are placed on a fixed triangular wedge by means of a massless, inextensible string and a frictionless pulley as shown in figure. The wedge is inclined at 45° to the horizontal on both the sides. The coefficient of friction between the block A and the wedge is 2/3 and that between the block B and the wedge is 1/3 and both the blocks A and B are released from rest, the acceleration of A will be



(a) -1
(b) 1.2
(c) 0.2
(d) zero

Answer: d
Solution



For B $2mg\sin 45° - \mu_1 R_1 - T_2 = 2ma$

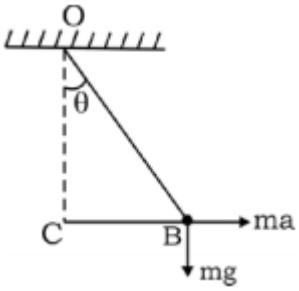
$$\Rightarrow 2mg \times \frac{1}{\sqrt{2}} - \frac{1}{3} 2mg \cos 45° - T = 2ma \Rightarrow \frac{2mg}{\sqrt{2}} - \frac{2mg}{3\sqrt{2}} - T = 2ma$$

$(m_B - m_A) g \sin\theta = \frac{mg}{\sqrt{2}}$ *is lesser*

$(\mu_B m_B + \mu_A m_B) g \cos\theta = (4mg/3\sqrt{2})$ *the masses will not move*

acceleration of B = acceleration of A = 0

10. A plumb line is suspended from the roof of a carriage moving with an acceleration a. If plumb line gets inclined at an angle θ with



vertical, then

(a) a = g tanθ
(b) a = dv/dt
(c) $a = d^2x / dt^2$
(d) a = f/m

Answer: a
Solution

$$\frac{ma}{CB} = \frac{mg}{OC} \text{ or } a = g \times \frac{CB}{OC} = g\tan\theta$$

11. A 0.5 kg ball is thrown up with an initial up with an initial speed 14 m/s and reaches a maximum height of 8.0 m. How much energy is dissipated by air drag acting on the ball during the ascent

(a) 19.6 Joule
(b) 4.9 Joule
(c) 10 Joule
(d) 9.8 Joule

Answer: d
Solution

If there is no air drag then maximum height

$$H = \frac{u^2}{2g} = \frac{14 \times 14}{2 \times 9.8} = 10 \text{ m}$$

But due to air drag ball reaches up to height 8m only.
So loss in energy $= mg(10 - 8) = 0.5 \times 9.8 \times 2 = 9.8$ J

12. A bomb of mass 1 kg is thrown vertically upwards with a speed of 100 m/s. After 5 seconds, it explodes into two fragments. One fragment of mass 400 gram is found to go down with a speed of 25 m/s. what will happen to the second fragment just after the explosion? ($g = 10$ m /s^2)

(a) it will go upwards with speed 100 m/s
(b) it will go upwards with speed 40 m/s
(c) it will go upwards with speed 60 m/s
(d) it will go downwards with speed 40 m/s

Answer: a
Solution

From $v = \mu + at = 100 - 10 \times 5 = 50$ m/s
This is the velocity at the time of explosion. According to the principle of conservation of linear momentum

$$1 \times 50 = \frac{400}{1000} \times (-25) + \frac{600}{1000} \times v$$

$$50 + 10 = 0.6v$$

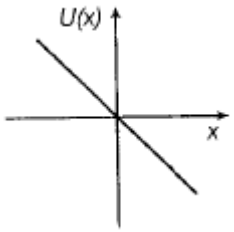
$$v = \frac{60}{0.6} = 100 \text{ m/s}$$

∴ The second fragment will go upwards

with a speed of 100 m/s.

13. A particle is placed at the origin and a force F = kx is acting on it (where k is positive constant). If U(0) = 0, the graph of U(x) versus x will be (where U is potential energy function)

(a)



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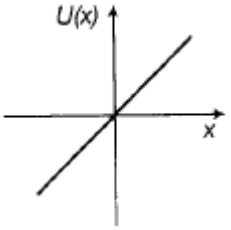
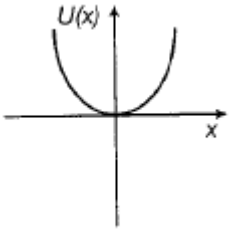


(c)



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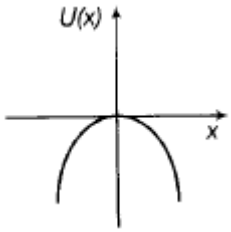


Answer: d
Solution

$$\text{Force } F = -\frac{dU(a)}{dx}$$

$$\Rightarrow \frac{dU(x)}{dx} = -kx \Rightarrow dU(x) = -kxdx$$

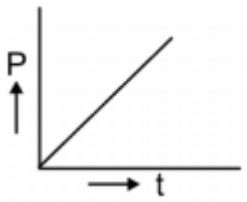
Integrating both the sides

$$U(x) = -\int kxdx = -\frac{1}{2}kx^2$$

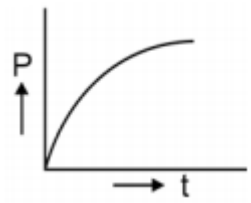
$$x^2 = -\frac{2}{k}U(x) \rightarrow (1)$$

14. A motor drives a body along a straight line with a constant force.The power P developed by the motor must very with time t as

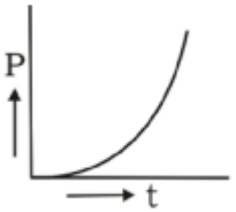
(a)



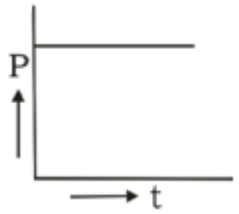
(b)



(c)



(d)



Answer: a
Solution

We know that $P = F \times v = F \times \frac{L}{T}$

As $F = MLT^{-2}$ = constant

$\therefore L \alpha T^2$

$\therefore P = F \times \frac{L}{T} = F \times \frac{T^2}{T} = F \times T$ or $P \alpha T$

Choice (a)is correct.

15. A mass m moves with a velocity v and collides inelastically with another identical mass. After collision the 1st mass moves with velocity $\frac{v}{\sqrt{3}}$ in a direction perpendicular to the initial direction of motion. Find the speed of the second mass after collision.

(a) v

(b) $\sqrt{3v}$

(c) $\frac{2}{\sqrt{3}} v$

(d) $\frac{v}{\sqrt{3}}$

Answer: c
Solution

In a direction.

$mU_1 + 0 = 0 + mv_x$

$\Rightarrow mv_x = mV$

$\Rightarrow v_x = V$

In y direction

$0 + 0 \Rightarrow m\left(\frac{v}{\sqrt{3}}\right) - mv_y$

$\Rightarrow v_y = v/\sqrt{3}$

Velocity of 2nd mass after collision

$V^1 = \sqrt{\left(\frac{V}{\sqrt{3}}\right)^2 + V^2} = \sqrt{\frac{4}{3}V^2}$

$V^1 = \frac{2}{\sqrt{3}} V$

16. A nucleus at rest splits into two nuclear parts having same density and radii in the ratio 1 : 2. Their velocities are in the ratio

(a) 2 : 1
(b) 4 : 1
(c) 6 : 1
(d) 8 : 1

Answer: d
Solution

Let a nucleus of mass M splits into two nuclear parts having masses M_1 and M_2 and radii R_1 and R_2 and densities ρ_1 and ρ_2.

$\therefore \quad M_1 = \rho_1 \frac{4}{3}\pi R_1^3$ and $M_2 = \rho_2 \frac{4}{3}\pi R_2^3$

Given : $\rho_1 = \rho_2$

$\therefore \quad \frac{M_1}{M_2} = \left(\frac{R_1}{R_2}\right)^3$

According to low conservation of linear momentum,

$M \times 0 = M_1 v_1 + M_2 v_2$

or $\frac{M_1}{M_2} = -\frac{v_2}{v_1}$

–ve sign show that both the parts are move in opposite direction in order to conserve the linear momentum

$\therefore \quad \frac{v_1}{v_2} = \frac{M_2}{M_1}$ or $\frac{v_1}{v_2} = \left(\frac{R_2}{R_1}\right)^3$

$\frac{v_1}{v_2} = \left(\frac{2}{1}\right)^3 = \frac{8}{1}$ $\left[\text{Given } \frac{R_1}{R_2} = \frac{1}{2}\right]$

17. A body of mass 2 kg moving with a velocity of 3 ms $^{-1}$ collides head on with a body of mass 1 kg moving in opposite direction with a velocity of 4 ms^{-1}. After collision two bodies stick together and move with a common velocity which in ms $^{-1}$ is equal to

(a) 2018/01/04
(b) 2018/01/03
(c) 2018/02/03
(d) 2018/03/04

Answer: c
Solution

From law of conservation of momentum

$m_1v_1 - m_2v_2 = (m_1 + m_2)V$

$\Rightarrow 2 \times 3 - 1 \times 4 = (2 + 1)V$

$V = \frac{2}{3} ms^{-1}$

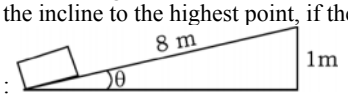
18. A light and a heavy body have equal momenta. Which one has greater K.E

(a) The light body
(b) The heavy body
(c) The K.E are equal
(d) Data is incomplete

Answer: a
Solution

$E = \frac{P^2}{2m}$ if P = constant then $E \propto \frac{1}{m}$

19. A mass of 2 kg rests on an inclined plane of gradient 1 in 8 as shown in fig. The work done in sliding it from the lowest point of the incline to the highest point, if the coefficient of friction is 0.2, is :



(a) 192 J
(b) 19.2 J
(c) 48 J
(d) 52 J

Answer: d
Solution

Here , $\sin\theta = \frac{1}{8}$, $\cos\theta \cong 1, s = 8m, \mu = 0.2$

$W = mg(\sin\theta + \mu\cos\theta) \times s$

$= 2 \times 10\left(\frac{1}{8} + 0.2 \times 1\right) \times 8 = 52$ J

20. A lorry and a car moving with the same K.E. are brought to rest by applying the same retarding force, then

(a) Lorry will come to rest in a shorter distance
(b) Car will come to rest in a shorter distance
(c) Both come to rest in a same distance
(d) None of the above

Answer: c
Solution

Stopping distance $= \frac{\text{kinetic energy}}{\text{retarding force}} \Rightarrow s = \frac{1}{2}\frac{mv^2}{F}$

If lorry and car both possess same kinetic energy and retarding force is also equal then both come to rest in the same distance.

21. Be and Al exhibit diagonal relationship. Which of the following statements about them is/are not true?
I. Both react with HCl to liberate H_2.
II. They are made passive by HNO_3.
III. Their carbides gives acetylene on treatment with water.
IV. Their oxides are amphoteric.

(a) III and IV
(b) I and III
(c) Only I
(d) II and III
(e) Only III

Answer: e
Solution

$BeC + 2H_2O \rightarrow CH_4 + 2BeO$

$Al_4C_3 + 6H_2O \rightarrow 3CH_4 + 2Al_2O_3$

22. In which of the following arrangements, the sequence is not strictly according to the property written against it?

(a) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power
(b) HF < HCl < HBr < HI : increasing acid strength
(c) $NH_3 > PH_3 < AsH_3 < SbH_3$: increasing basic strength
(d) B < C < O < N : increasing first ionisation enthalpy

Answer: c
Solution

Increasing order of basic strength

$SbH_3 < AsH_3 < PH_3 < NH_3$

NH_3 is most basic because of its 8 small size.

As size increases ability to donate electron pair decreses.

23. In which of the following arrangements the order is not according to the property indicated against it?

(a) Li < Na < K < Rb increasing metallic radius
(b) I < Br < F < Cl increasing electron gain enthaly (with negative sign)
(c) B < C < N < O increasing first ionisation enthalpy
(d) $Al^{3+} < Mg^{2+} < Na^+ < F^-$ increasing ionic size

Answer: c
Solution

a) In a group, metallic radius increases from top to bottom. So, Li<Na<K<Rb is true
b) Electron gain enthalapy decreases along a group thus I<Br<F<Cl
c) Ionisation enthalapy increases along a period from left to right but due to presence of half filled orbital in N, IE of N>0.
B<C<N<O is increases.
d) For isoelectronic species ionic size$\propto \frac{1}{atomic\ size}$
So, Ionic size order is
$Al^{3+} < Mg^{2+} < Na^+ < F^-$ is correct.

24. Electron affinity is positive, when

(a) O changes into O^-
(b) O^- changes into O^{2-}
(c) O changes into O^+
(d) electron affinity is always negative

Answer: b
Solution

When an electron is added, the change in energy is the electron affinity for endothermic change, electron affinity is positive when O^- changes O^{2-}. O^{2-} repels the incoming electron due to similar charge. So it needs energy to accept the electron. Hence electron affinity is positive.

25. Ionic radius is

(a) inversely proportional to effective nuclear charge
(b) inversely proportional to square of effective nuclear charge
(c) directly proportional to effective nuclear charge
(d) directly proportional to square of effective nuclear charge

Answer: a
Solution

Ionic radius$\propto \frac{1}{Z_{eff}}$

Z_{eff} = effective nuclear charge

Z_{eff} = Z- screening constant (σ)

The value of screening constant depends upon electrons in valence shell and penultimate shells.

26. Pauling's equation for determining the electronegativity of an element, is
where, X_A, X_B = electronegativity values of elements A and B, Δ = represents polarity of A-B bond.

(a) $$X_A - X_B = 0.208\sqrt{\Delta}$$

(b) $$X_A + X_B = 0.208\sqrt{\Delta}$$

(c) $$X_A - X_B = 0.208\,\Delta^2$$

(d) $$X_A - X_B = \sqrt{\Delta}$$

Answer: a
Solution
According to pauling equation

$X_A - X_B = 0.208\sqrt{\Delta}$

$X_A, X_B \rightarrow$ electronegativity of A&B

$\Delta \rightarrow$ polarity of A-B bond.

27. Identify the correct order in which the covalent radius of the following elements increases
I. Ti
II. Ca
III. Sc

(a) I, II and III
(b) III, II and I
(c) II, I and III
(d) I, III and II

Answer: d
Solution
$_{20}Ca = [Ar]4s^2$

$_{21}Sc = [Ar]4s^2, 3d^1$

$_{22}Ti = [Ar]4s^2, 3d^2$

We know that d-orbitals have diffused shape,

hence their electron shields nuclear charge up

to lesser extent. Hence, due to increase in effective

nuclear charge
(Z_{eff}) atomic size decreases, in the following order.

Ca>Sc>Ti

28. Which of the following sets has the atoms and/or ions in the correct order of increasing size?

(a) $Ne < F^- < 0^{2-}$
(b) $Br^- < Cl^- < F^-$
(c) $Na^+ < Mg^{2+} < Al^{3+}$
(d) P < S < Cl

Answer: a
Solution
In case of Br^-, Cl^-, F^- the correct order will be

$F^- < Cl^- < Br^-$ as they belong to same group.

Order of Na^+, Mg^{2+} and Al^{3+} is

$Al^{3+} < Mg^{2+} < Na^+$

These are iso-electronic speeds

In case of p, s and Cl, the correct order is Cl<s<p

They belong to same period.

29. The general electronic configuration of the transition elements is

(a) $(n-1)d^{10}, (n+1)s^2$
(b) $(n-1)d^{1-10}, (n+1)s^{1-2}$
(c) $(n-1)d^{1-10}, np^6, ns^2$
(d) $(n-1)d^{1-10}, ns^{1-2}$

Answer: d
Solution
The general electronic configuration is

$(n-1)d^{1-10}ns^{1-2}$

Last electron is entering into d subshell so

these are d-block element. d-block elements

are known as transition elements.

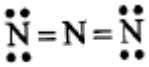
30. The order of stability of metal oxides is

(a) $Al_2O_3 < MgO < Fe_2O_3 < Cr_2O_3$
(b) $Cr_2O_3 < MgO < Al_2O_3 < Fe_2O_3$
(c) $Fe_2O_3 < Cr_2O_3 < Al_2O_3 < MgO$
(d) $Fe_2O_3 < Al_2O_3 < Cr_2O_3 < MgO$

Answer: c
Solution
Order of stability of metal oxides is

$Fe_2O_3 < Cr_2O_3 < Al_2O_3 < MgO$

31. In the following electron-dot structure, —calculate the formal charge from left to right nitrogen atom,



(a) -1, -1, + 1
(b) -1, + 1, - 1
(c) +1, -1, - 1
(d) + 1, -1, + 1

Answer: b
Solution
Consider ,

Now,

Formal charge (FC) = No. of valence electron in free neutral atom $-\frac{1}{2}$[No. of bonding electrons] −[No. of non − bonding electrons]

For N_1,

$FC = 5 - \frac{1}{2}[4] - 4$
$= 5 - 2 - 4$
$= 5 - 6 = -1$

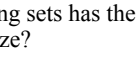
For N_2,

$FC = 5 - \frac{1}{2}[8] - 0 = 5 - 4 = +1$

For N_3,

$FC = 5 - \frac{1}{2}[4] - 4 = 5 - 2 - 4 = -1$

∴ For ,

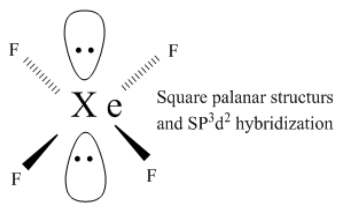


Formal charge form left to right nitrogen is $-1, +1, -1$.

32. The shape of XeF_4 molecule and hybridisation of xenon in it are

(a) tetrahedral and sp^3
(b) square planar and dsp^2
(c) square planar and sp^3d^2
(d) octahedral and sp^3d^2
(e) octahedral and d^2sp^3

Answer: c
Solution



Square palanar structurs and SP^3d^2 hybridization

33. When O_2 is converted into O_2^+

(a) both paramagnetic character and bond order increase
(b) bond order decreases
(c) paramagnetic character increases
(d) paramagnetic character decreases and the bond order increases

Answer: d
Solution

BO of $O_2 = 2$ and that of $O_2^+ = 2.5$

Hence when O_2 is converted into O_2^+, paramagnetic character decreases and the bond order increases.

34. Among the following, the pair in which the two species are not isostructural, is

(a) SiF_4 and SF_4

(b) IO_3^- and XeO_3

(c) BH_4^- and NH_4^+

(d) PF_6^- and SF_6

Answer: a
Solution

Compound	Structure / Geometry
SiF_4	Tetrahedral
SF_4	Trigonal bipyramid
IO_3^-	Trigonal piramidal
XeO_3	Trigonal piramidal
BH_4^-	Tetrahedral
NH_4^+	Tetrahedral
PF_6^-	Octahedral
SF_6	Octahedral

35. AB is an ionic solid. The ionic radii of A^+ and B^- are respectively r_c and r_a . Lattice energy of AB is proportional to

(a) $\frac{r_c}{r_a}$

(b) $(r_c + r_a)$

(c) $\frac{r_a}{r_c}$

(d) $\frac{1}{(r_c + r_a)}$

Answer: d
Solution

$U_L = K \cdot \frac{v \cdot |2^+| \cdot |2^-|}{r^+ + r^-}\left(1 - \frac{d}{r^+ + r^-}\right)$

Where $K = 1.2025 \times 10^{-4}$ J.m.mol^{-1}

$d = 3.45 \times 10^{-11}$ m

v = number of ions in the empirical formula

2^+ and 2^- = number of elecmentary charge on the cation and anion respectively

r^+ and r^- = radii of cation and anion respectively

Hence, $U_L \propto 1/r$

Therefore, for ionic solid AB,

$U_L \propto \frac{1}{r_{A^+} + r_{B^-}} \propto \frac{1}{r_c + r_a}$

36. The compound in which the number of $d\pi - p\pi$ bonds are equal to those present in ClO_4^-

(a) XeF_4
(b) XeO_3
(c) XeO_4
(d) XeF_6

Answer: b
Solution

1. The structure of XeO_3

∴Three $p\pi - d\pi$ bonds are present

2. The structure of ClO_4^-

∴ Three $p\pi - d\pi$ bonds are present.

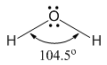
Hence ClO_4^- and XeO_3 both contain $3d\pi - p\pi$ bonds.

37. Which one of the following is a correct set?

(a) H_2O, sp^3, angular
(b) BCl_3 , sp^3, angular
(c) NH^+4 , dsp^2, square planar
(d) CH_4 , dsp^2 , tetrahedral

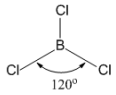
Answer: a
Solution

1) Water (H_2O) molecule



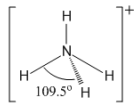
Bent or angluar shape and Sp^3 hybridization

2) BCl_3 (Borontrichloride)



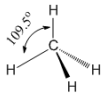
Trigonal planar structure with Sp^2 hybridization

3) NH_4^+ (Ammonium cation)



Sp^3 hybridization with tetrahedral geometry

4) CH_4 (methane)



Sp^3 hybridization with tetrahedral geometry

38. A diatomic molecule has a dipole moment of 1.2 D. If its bond distance of 1.0 Å, what fraction of an electronic charge, e, exist on each atom?

(a) 25% of e
(b) 50% of e
(c) 60% of e
(d) 75% of e

Answer: a
Solution

Given, $\mu = 1.2D, r = 1.0Å, = 1.0 \times 10^{-8}$ cm, q =?

$= 1.2 \times 10^{-18}$ esu. cm

Now, $\mu = qr$

$\Rightarrow q = \frac{\mu}{r} = \frac{1.2 \times 10^{-18}}{1.0 \times 10^{-8}} = 1.2 \times 10^{-10}$ esu

In a polar molecules, when proton and electron 100 pm apart, the dipole moment will be 4.80 D then ionic charge

$$q = \frac{4.80 \times 10^{-18}.\text{esu. cm}}{1.0 \times 10^{-8}\text{cm}}$$

$$q = 4.80 \times 10^{-10}.\text{esu. ofe}$$

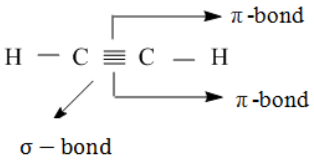
Thus fraction of $= \frac{1.2 \times 10^{-10}}{4.8 \times 10^{-10}} \times 100 = 25\%$ ofe. electronic charge

39. In acetylene molecule between the carbon atoms there are

(a) three pi bonds
(b) one sigma and two pi bonds
(c) two sigma and one pi bonds
(d) three sigma bonds

Answer: b

Solution



40. Which species has the maximum number of lone pair of electrons on the central atom ?

(a) $[ClO_3^-]$

(b) XeF_4

(c) SF_4

(d) $[I_3^-]$

Answer: d

Solution

Based on VSEPR theory, we can predict the structure (geometry) of individual molecules from the number of electron pairs surrounding their central atoms

	Compound	No.of lone pair of electrons	Hybridization	Structure
1	ClO_3^-	1	Sp^3	Trigonal Pyramidal
2	XeF_4	2	Sp^3d^2	Square Planar
3	SF_4	1	Sp^3d	Irregural tectrahedral
4	$[I_3^-]$	3	Sp^3d	Linear

41. Myrosin in plant parts is characteristic of -

(a) Cruciferae
(b) Malvaceae
(c) Solanaceae
(d) Liliaceae

Answer: a

42. Ebracteate flowers mainly found in -

(a) Solanaceae
(b) Malvaceae
(c) Cruciferae
(d) Liliaceae

Answer: c

43. Placentation of cruciferae plant is -

(a) Parietal
(b) Axial
(c) Basal
(d) Marginal

Answer: a

44. Mustard oil is obtained from -

(a) Brassica compestris
(b) Brassica oleracea
(c) Brassica rapa
(d) Capsella bursa pestoris

Answer: a

45. In Cruciferae the two carpels in each flowers are placed -

(a) Transversely
(b) Obliquely
(c) Anteroposteriorly
(d) Separately

Answer: a

46. Cherianthus cheiri is used in -

(a) Bronchities and fever
(b) Hydrophobia
(c) Allergy
(d) Mental disorder

Answer: a

47. "Halima" a medicinal plant belongs to family -

(a) Cruciferae
(b) Solanaceae
(c) Malvaceae
(d) Papilionatae

Answer: a

48. Edible part of knol khol is -

(a) Inflorescence
(b) Leaves
(c) Roots
(d) Stem

Answer: d

49. The botanical name of 'black mustard' is –

(a) Brassica nigra
(b) Brassica juncea
(c) Brassica napus
(d) Brassica compastris

Answer: c

50. Which of the following is not a seed surface fiber-

(a) Kapok
(b) Silk cotton
(c) Cotton
(d) Dhaincha

Answer: d

51. A sarcodine causing dysentery is

(a) Giardia
(b) Entamoeba
(c) Amoeba
(d) Tryapnosoma

Answer: b

52. Silica shells may or may not occur in one of the following

(a) Amoeboids
(b) Heliozoans
(c) Radiolarians
(d) Foraminiferans

Answer: b

53. Tetranucleated cyst stage is found in

(a) Entamoeba coli
(b) Entamoeba histolytica
(c) Leishmania
(d) Trypanosome

Answer: b

54. The skeleton of bath sponge, Euspongia is made of

(a) Spongin fibres
(b) Siliceous spicules
(c) Calcareous spicules
(d) Spongin fibres and siliceous spicules

Answer: a

55. A sponge harmful to oyster industry is

(a) Spongilla
(b) Euspongia
(c) Hyalonema
(d) Cliona

Answer: d

56. Which of the following lives in commensal

(a) Leucosolenia
(b) Euplectella
(c) Euspongia
(d) Sycon

Answer: b

57. Mode of digestion in sponges is

(a) Intracellular
(b) Intercellular
(c) Inracellular and intercellular
(d) None of these

Answer: a

58. The correct sequence of varios larvae in liver fluke is

(a) (1) Miracidium, sporocyst, cercaria, redia, metacercaria
(b) (2) Miracidium, sporocyst, redia, cercaria, metacercaria
(c) (3) Sporocyst, redia, miracidiium, cercaria, metacercaria
(d) (4) Carcaira, sporocyst, redia, miracidium

Answer: b

59. Taenia saginata differs from Taenia solium in

(a) Absence of scolex hooks
(b) Scolex devoid of hook and difference in secondary host
(c) Absence of scolex hooks and presence of both male and female reproductive organs
(d) Presence of scolex hooks

Answer: b

60. A temporary clitellum occur during the breeding season in

(a) Pheretima
(b) Heteronereis
(c) Hirudinaria
(d) Aphrodite

Answer: c