BIOLOGY

SOL. 1 (B)

SOL. 2 (A)

SOL. 3. (c) : Ex situ conservation means "offsite Conservation". It is the process of protecting endangered species of plants and animals by removing it from an unsafe or threatened habitat and placing it or part of it under the care of humans. Botanical garden serve as ex situ conservation of germplasm of different plants, to maintain rare and endemic plant species and also to provide recreation and knowledge about plants to a common man.
Sol.4 (d) : Halophiles, a type of archaebacteria, usually Occur in extreme saline conditions like salt pans, salt Beds and salt marshes
Sol. 5 (c) : TMV is rod shaped measuring 300 × 20 nm. It is made of RNA and proteins.
Sol. 6 (a)
Sol .7 (b) : Ectocarpus possesses haplodiplontic whereas Fucus possesses diplontic life cycle.
Sol. 8 (c) : The alimentary canal of birds have additional chambers, the crop and gizzard. Crop stores and softens the food, however the gizzard helps in crushing and churning the food.
Sol. 9 (a) : The flowers of Brassica are radially symmetrical whereas flowers of Trifolium, Pisum and Cassia are zygomorphic.
Sol. 10 (b) : The given figure in option (b) represents the free central placentation. In free central placentation,ovary is unilocular and ovules are borne on the axis in the center of the ovary and septa are absent. It is seen in Dianthus and Primrose
Sol. 11 (d) : The leaf and stem epidermis of plant is covered with pores called stomata. Each stomata is surrounded by a pair of specialised epidermal cells known as guard cells which are in some cases further surrounded by another category of less modified epidermal cells known as subsidiary cells which provide support to the guard cells.
Sol . 12 (a)
Sol . 13 (c) : Organelles can be separated from cell homogenate through differential centrifugation. The basic principle involved here is sedimentation of particles in a suspension by centrifugal force. In a centrifuge, the particles sediment at different rates when an accelerating force is subjected. The rate of sedimentation depends upon the size of the particles, its shape and density
sol. 14 (b)
sol .15 (a) : Chitin is a structural polysaccharide that constitutes the exoskeleton of arthropods. It is a complex carbohydrate in which N-acetyl glucosamine monomers are joined together by (1, 4) β-linkages. Chitinous exoskeleton provides strength and elasticity to arthropods.
Sol . 16 (b) : In cell cycle, there are two main phasesinterphase and mitotic phase. Interphase is divided into 3 stage G1, S and G2. G1 is first growth phase. S is synthetic phase and G2 is second growth phase.
Sol . 17(b) : Facilitated transport or facilitated diffusion is the spontaneous passage of molecules or ions across a biological membrane passing through specific transmembrane integral proteins. Facilitated diffusion is ediated by protein channels and carrier proteins. Most transport proteins that mediate facilitated diffusion are very selective and only transport certain molecules. The major classes of proteins involved in facilitated diffusion are aquaporins, ion channels and carrier proteins. Importantly, neither channels nor carrier proteins require energy to facilitate the transport of molecules; they enable molecules to move down their concentration gradients (downhill transport).
Sol .18 (c) : The entry of water in cell develops turgor pressure, which exerts pressure on the cell wall. Cell wall counteracts the turgor pressure. As the turgor pressure increases, wall pressure also increases to prevent the cell from bursting.
Sol. 19 (c) : Gray spot diseases of oat is caused due to deficiency of manganese. Its symptoms include greyishbrown elongated specks and streaks, empty panicles,interveinal chlorosis on stem and leaves. The symptoms that occur only on leaves are irregular, greyish brown lesions which coalesce and bring about collapse of leaf.This is called grey speck symptom.
Sol 20 (a) : Molybdenum is a micronutrient which is required in very minute amount by the plants. It is responsible for nodulation in legumes. It is part of nitrate reductase enzyme which helps in nitrogen fixation

PHYSICS

Sol.21

34. (c) : Induced emf $|\varepsilon| = L\frac{dI}{dt}$

where L is the self inductance and $\frac{dI}{dt}$ is the rate of change of current.

∴ Dimensional formula of

$$L = \frac{|\varepsilon|}{\frac{dI}{dt}} = \frac{[ML^2T^{-3}A^{-1}]}{[AT^{-1}]} = [ML^2T^{-2}A^{-2}]$$

Sol. 22

(c) : Units of $b = \frac{x}{t^2} = \frac{\text{km}}{\text{s}^2}$

Sol. 23 (b) : Total distance travelled = 200 **m**

$$\text{Total time taken} = \frac{100}{40} + \frac{100}{v}$$

$$\text{Average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

$$48 = \frac{200}{\left(\frac{100}{40} + \frac{100}{v}\right)} \text{ or } 48 = \frac{2}{\left(\frac{1}{40} + \frac{1}{v}\right)}$$

$$\text{or } \frac{1}{40} + \frac{1}{v} = \frac{1}{24} \text{ or } \frac{1}{v} = \frac{1}{24} - \frac{1}{40} = \frac{5-3}{120} = \frac{1}{60}$$

or $v = 60$ km/h

Sol. 24

(d) : Because the slope is highest at C,

$v = \frac{ds}{dt}$ is maximum

Sol. 25 (b) : In one dimensional motion, the body can have one value of velocity at a time but not two values of velocities at a time.

Sol. 26 (D)

Action = Energy × Time
= $M^1L^2T^{-2} \times T^1$
= $M^1L^2T^{-1}$

Sol. 27 (B)

Fundamental quantities does not depends each other So, in length, time and velocity here velocity is derived quantities.

Sol. 28 (C)

The magnitude of acceleration is constant in (A) and decreasing in (B)

In (A) → r constant, $a_t = 0$;

v constant , $a_r = \frac{V^2}{R}$ constant

In (B) → r is increasing , V constant

$a_t = 0$; $a_r = \frac{V^2}{R}$ decreasing

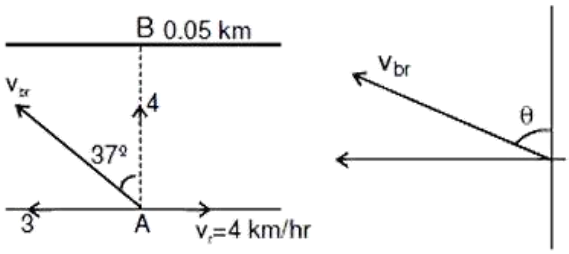
Sol. 29 (A)

If v = 0 or v = constant then frame is inertial.

Sol. 30 (B) (13/5) P

Sol. 31 (A) Displacement from the mean position

Sol. 32 (B)



$V_{br} = 5$ km/hr

$\sin\theta = \frac{v_r}{5}$

$t = \frac{d}{v_{br}\cos\theta} \Rightarrow \cos\theta = \frac{4}{5} \Rightarrow \theta = 37º$

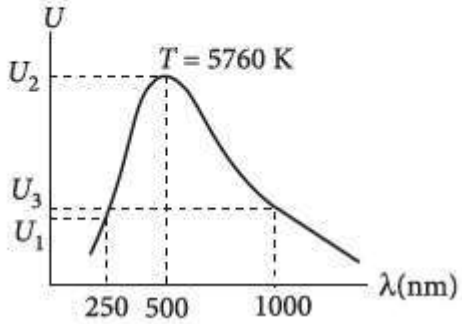
$\sin 37º = \frac{v_r}{5} \Rightarrow v_r = 3\text{km/hr}$

Sol. 33 (D)

Sol. 34 (A) 1: 2

Sol. 35 (B) : According to Wein's displacement law

$$\lambda_m = \frac{b}{T} = \frac{2.88\times10^6 \text{ nm K}}{5760 \text{ K}} = 500 \text{ nm}$$



Sol. 36 (C)

Let d_{min} = minimum diameter of brass.

Then, stress in brass rod is given by

$$\sigma = \frac{F}{A} = \frac{4F}{\pi d^2_{min}} \qquad \left[\because A = \frac{\pi d^2}{4}\right]$$

For stress not to exceed elastic limit, we have

$\sigma \le 379$ MPa

$$\Rightarrow \quad \frac{4F}{\pi d^2_{min}} \le 379\times10^6$$

Here, $F = 400$ N

$$\therefore \quad d^2_{min} = \frac{1600}{\pi \times 379\times10^6}$$

$$\Rightarrow \quad d_{min} = 1.16\times10^{-3} \text{ m} = 1.16 \text{ mm}$$

Sol.37 (D)

Let mass of given body is m. Then, it's weight on earth's surface = mg_e

where, g_e = acceleration due to gravity on earth's surface

and weight on the surface of planet = mg_p

g_p = acceleration due to gravity on planet's surface.

Given,

$$\frac{mg_e}{mg_p} = \frac{9}{4} \Rightarrow \frac{g_e}{g_p} = \frac{9}{4}$$

But $g = \frac{GM}{R^2}$, so we have

$$\frac{\left(\frac{GM}{R^2}\right)}{\left(\frac{GM_p}{R_p^2}\right)} = \frac{9}{4}$$

where, M = mass of earth,

R = radius of earth,

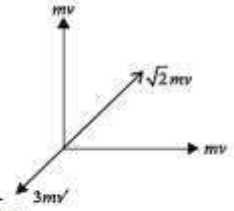
M_p = mass of plane = $\frac{M}{9}$ (given)

and R_p = radius of planet.

$$\Rightarrow \quad \frac{M}{M_p}\cdot\frac{R_p^2}{R^2} = \frac{9}{4} \Rightarrow 9\cdot\left(\frac{R_p}{R}\right)^2 = \frac{9}{4}$$

$$\Rightarrow \quad \frac{R_p}{R} = \frac{1}{2} \Rightarrow R_p = \frac{R}{2}$$

Sol.38 (D)



Let the speed of the third fragment of mass $3m$ be v'. From law of conservation of linear momentum,

$$3mv' = \sqrt{2}\,mv \Rightarrow v' = \frac{\sqrt{2}\,v}{3} \qquad ...(i)$$

$\therefore$ Energy released during the process is,

$$\text{K.E.} = 2\left(\frac{1}{2}mv^2\right) + \frac{1}{2}(3m)v'^2 = mv^2 + \frac{1}{2}(3m)\frac{2v^2}{9}$$

(Using eqn. (i))

$$= mv^2 + \frac{mv^2}{3} = \frac{4}{3}mv^2$$

Sol. 39 (D)

According to question, velocity of unit mass varies as

$$v(x) = \beta x^{-2n} \qquad ...(i)$$

$$\frac{dv}{dx} = -2n\beta x^{-2n-1} \qquad ...(ii)$$

Acceleration of the particle is given by

$$a = \frac{dv}{dt} = \frac{dv}{dx}\times\frac{dx}{dt} = \frac{dv}{dx}\times v$$

Using equation (i) and (ii), we get

$$a = (-2n\beta x^{-2n-1}) \times (\beta x^{-2n}) = -2n\beta^2 x^{-4n-1}$$

sol. 40 (B) decrease

Chemistry

Sol. 41

(b) : Species	No. of electrons
Be^{2+}	2
H^+	0
Li^+	2
Na^+	10
Mg^{2+}	10

Sol 42 (a) : No. of radial nodes in 3p-orbital = n – l – 1 = 3 – 1 – 1 = 1

Sol. 43 (a)

Sol. 44 (d) : Within a period from left to right, atomic volume first decreases and then increases

Sol. 45 (c) : BCl3-Trigonal planar, sp2-hybridised, 120° angle.

Sol. 46 (A)

	N_2	+	$3H_2$	→	$2NH_3$
	1 mole		3 mole		2 mole
or	1/2 mole		3/2 mole		1 mole
or	$10 \times 1/2 = 5$		$10 \times 3/2 = 15$		$10 \times 1 = 10$

As only 50% ammonia formation is expected so composition of gaseous mixture under the above mentioned condition is as follows:

$H_2 = 30 - 15 = 15$ L

$N_2 = 30 - 5 = 25$ L

$NH_3 = 10$ L

Sol. 47 (C) 1 mole of electrons weighs 0.54 mg

Sol. 48 (C) Ni^{2+}, Ti^{3+}

Sol. 49(A) B < Be < C < O < N

Sol. 50 (A) Three

Sol. 51 (C) 1/8

Sol. 52 (A) but-3-enoic acid

Sol. 53 (C) 3-bromo-1-chlorocyclohexene

Sol. 54 (D) B_2H_6

Sol. 55 (B)

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

Therefore, dimensions of pressure $= \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$

and dimensions of energy per unit volume

$$= \frac{\text{Energy}}{\text{Volume}} = \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$$

Sol. 56 (A) 1 and 2

Sol. 57 (C)

$$3C + 2Al_2O_3 \longrightarrow 4Al + 3CO_2$$

(From bauxite)

4 moles of Al is produced by 3 moles of C.

1 mole of Al is produced by $\frac{3}{4}$ mole of C.

$\frac{270 \times 1000}{27} = 10^4$ moles of Al is produced by $\frac{3}{4} \times 10^4$ moles of C.

Amount of carbon used $= \frac{3}{4} \times 10^4 \times 12$ g

$$= \frac{3}{4} \times 10 \times 12 \text{ kg} = 90 \text{ kg}$$

Sol . 58(A)

Species having same no. of electrons are called isoelectronic species.

The no. of electrons in $CO = CN^- = NO^+ = C_2^{2-} = 14$. So, these are isoelectronic species.

Sol. 59(D)

Unnilunium – Mendelevium ⇒ (a)-(i)

Unniltrium – Lawrencium ⇒ (b)-(ii)

Unnilhexium – Seaborgium ⇒ (c)-(iii)

Unununnium – Roentgenium ⇒ (d)✕(iv)

Sol. 60 (C) Along the period, as we move from Li → Be → B → C, the electronegativity increases and hence the EN difference between the element and Cl decreases and accordingly, the covalent character increases. Thus LiCl < $BeCl_2$ < BCl_3 < CCl_4 is the correct order of covalent bond character.