

# MOTION

Student's Solution Copy [CODE - 25449]

NEET PATTERN TEST Brahmastra Semi Major Test-02

13th NEET - Phase 12

KOTA

Date: 19-Jan-2025

Duration: 3 Hours 20 Mins

Max Marks: 720

## Chemistry - Section A

1. Answer: 4

Sol:

$$K_C \propto \frac{1}{\text{Conc. of reactants}}$$

2. Answer: 2

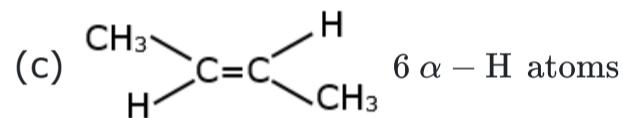
Sol:

$$\text{HOH} \propto \frac{1}{\text{Stability of alkene}}$$

$$\propto \frac{1}{\text{Hyper conjugation}} \propto \frac{1}{\text{No. of } \alpha-\text{H atoms}}$$

(a)  $\text{CH}_2=\text{CH}_2$  - 0  $\alpha$ -H atoms

(b)  $\text{CH}_3-\text{CH}=\text{CH}_2$  3  $\alpha$ -H atoms



Stability order is : c > b > a

HOH order is : a > b > c

3. Answer: 2

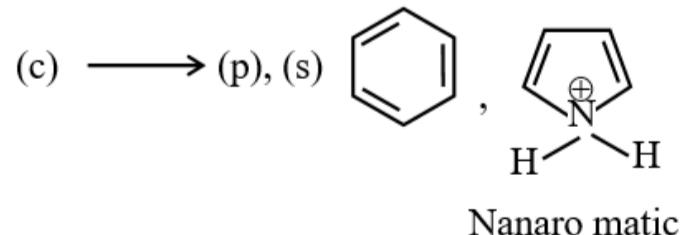
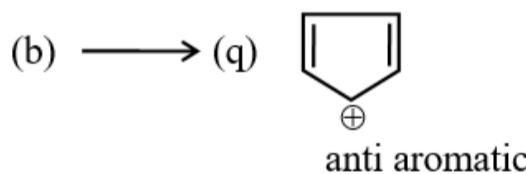
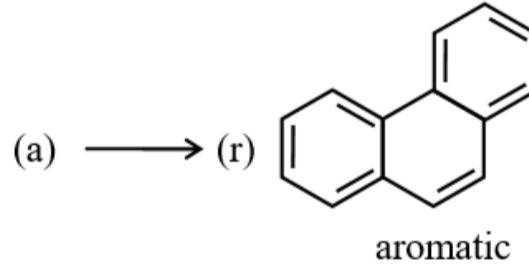
Sol:



+ve charge↑ zeff↑ EN↑ NMC↑ A.S↑

4. Answer: 3

Sol:



5. Answer: 3

6. Answer: 2

**Sol:**

$$\frac{K_p}{K_c} = 3$$

$$\frac{K_c(RT)^1}{K_c} = 3$$

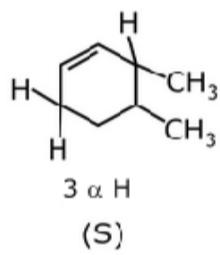
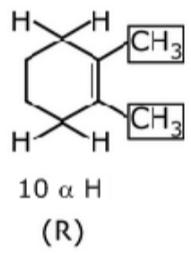
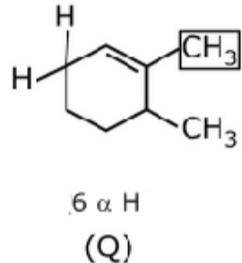
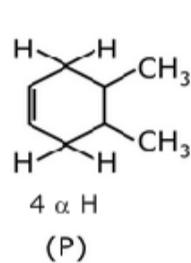
$$R \times T = 3$$

$$T = \frac{3}{0.0821}$$

$$T = 36.54 \text{ K}$$

**7. Answer: 1**

**Sol:**



No. of  $\alpha$  - H : R > Q > P > S

Stability of alkene : R > Q > P > S

More the no. of  $\alpha$  - H more the stability of alkene.

**9. Answer: 4**

**Sol:**

Due to inert pair effect stability of Ios increases

**11. Answer: 1**

**Sol:**

Le Chatelier's principle can be used to predict the behavior of a system due to changes in pressure, temperature, or concentration. Le Chatelier's principle implies that the addition of heat to a reaction will favor the endothermic direction of a reaction as this reduces the amount of heat produced in the system.

**Sol:**

The bond dissociation energy of the halogens decreases down the group because size of the atom increases. A halogen molecule having larger atoms should have low dissociation energy

Fluorine is an exception because interelectronic repulsion is present in small atom fluorine.

Correct order :  $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$

**8. Answer: 4**

**Sol:**

$$\text{II} + \text{I} \times 2 = \text{III}$$

$$K_3 = K_1^3 K_2$$

**10. Answer: 4**

**Sol:**

(III) Delocalization , (IV) Aromaticity, (I)  $\text{sp}^2$  'N' no delocalization, (II)  $\text{sp}^3$  'N' + I effect

**12. Answer: 1**

**Sol:**

Compound	Boiling point (K)
$\text{H}_2\text{O}$	373
$\text{H}_2\text{S}$	213
$\text{H}_2\text{Se}$	232
$\text{H}_2\text{Te}$	269

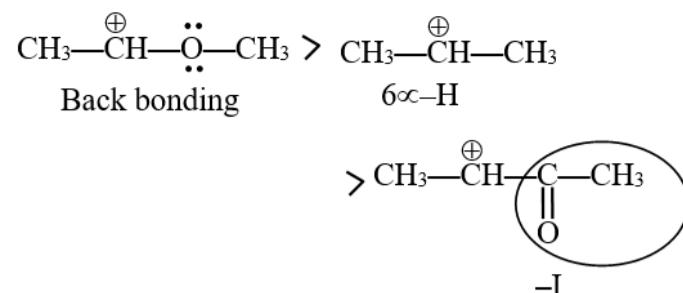
The boiling points of these hydrides not exactly increases with increase in molar mass.

$\text{H}_2\text{O}$  has maximum boiling point due to intermolecular hydrogen bonding.

**13. Answer: 4**

**14. Answer: 3**

**Sol:**



**Sol:**

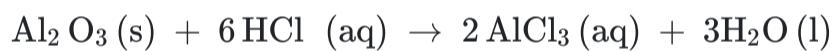
- Given ;  
 a reaction,  $\Delta H > 0$  (exothermic)  
 $K_P = 0.025 \text{ (atm)}^{-1}$   
 Unit of  $K_P = (\text{atm})^{\Delta n_g}$   
 $\Delta n_g = -1 = (n_P - n_R)g$   
 $(n_R)_g > (n_P)_g$
- (A) At low pressure equilibrium will shift in the direction where no. of moles are increasing i.e. in backward direction.  
 $\therefore n_R > n_P$
- (B) At high temp. equilibrium will shift in the direction where temp. is low i.e. in backward direction.  
 $\therefore \Delta H > 0$  (heat is also a product)
- (C)  $\because (n_R > n_P)$ , on removing product equilibrium will shift in the forward direction.
- (D) Removing reactants, results equilibrium to shift in the backward direction.

**15. Answer: 1**

**Sol:**

An amphoteric compound can react as both an acid and a base.

$\text{Al(OH)}_3$  behaves as acid as well as base.



**17. Answer: 2**

**Sol:**

Mass of  $\text{NaOH} = 4\text{g}$

Molar mass of  $\text{NaOH} = 40 \text{ gmol}^{-1}$

Molarity =  $\frac{4}{40} = 0.1 \text{ M}$

$[\text{OH}^-] = 0.1 \text{ M}$

We know that -

$$[\text{H}^+] [\text{OH}^-] = K_w$$

$$[\text{H}^+] = \frac{10^{-14}}{[\text{OH}^-]}$$

$$[\text{H}^+] = \frac{10^{-14}}{0.1}$$

$$[\text{H}^+] = 10^{-13}\text{M}$$

**19. Answer: 1**

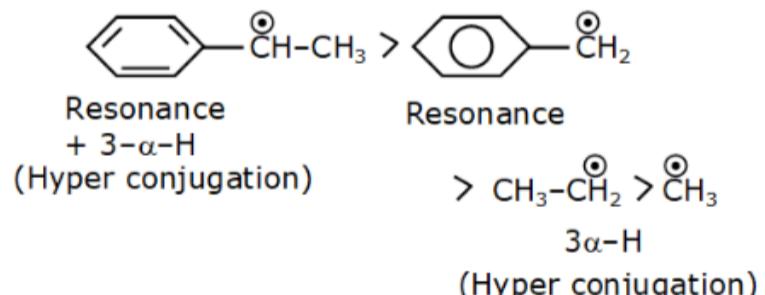
**16. Answer: 4**

**Sol:**

In equivalent resonance structure of acetate ion of  $\text{C=O}$  bond length are unequal

**18. Answer: 1**

**Sol:**



**20. Answer: 3**

**Sol:**

$$\text{Total Meq of H}_2\text{SO}_4 = \frac{1}{200} \times 2 \times 400 = 4$$

$$\text{Total Meq of HCl} = \frac{1}{100} \times 400 = 4$$

$$\text{Total volume} = 400 + 400 + 200 = 1000$$

$$N = \frac{400 \times \frac{1}{200} \times 2 + \frac{1}{100} \times 400}{1000}$$

$$N = \frac{4+4}{1000} = 8 \times 10^{-3}$$

$$\text{pH} = -\log [\text{H}^+]$$

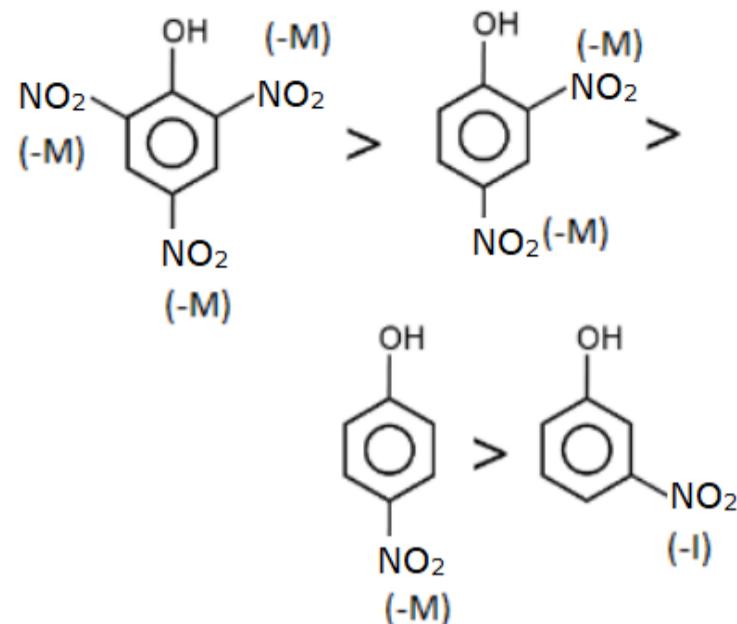
$$\text{pH} = -\log [8 \times 10^{-3}]$$

$$\text{pH} = 2.1$$

**Sol:**

Acidic strength  $\propto K_a$

Acidic strength  $\propto -M, -H, -I$



Increasing dissociation constant  $[K_a]$  is IV < II < I < III.

**21. Answer: 1****Sol:**

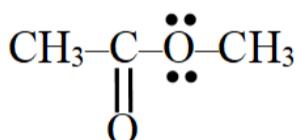
$$\therefore [\text{OH}^-] = C \cdot h = C \sqrt{\frac{K_H}{C}} = \sqrt{K_H \cdot C} = \sqrt{\frac{K_w}{K_a}} C$$

$$\text{or } -\log \text{OH} = -\frac{1}{2} [\log K_w + \log C - \log K_a]$$

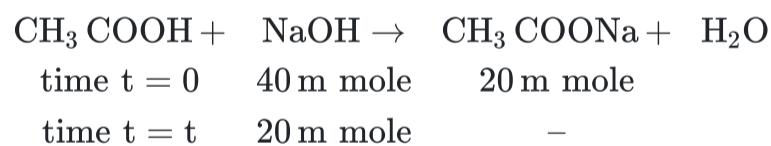
$$\text{or } \text{pOH} = \frac{1}{2} [\log K_w - \log C - \log K_a]$$

$$\text{Now } \text{pH} + \text{pOH} = \text{pK}_w$$

$$\therefore \text{pH} = \frac{1}{2} [\log C + \log K_a]$$

**22. Answer: 4****Sol:**

Neutral octet complete structure

**23. Answer: 2****Sol:**

20 m mole

$$\text{pH} = \text{pK}_a + \log \left( \frac{20}{20} \right) \Rightarrow \text{pH} = \text{pK}_a$$

$$\Rightarrow [\text{H}^+] = K_a = 1.8 \times 10^{-5} \text{ M}$$

**25. Answer: 4****24. Answer: 3****Sol:**

$$\text{pH} = \text{pK}_a + \log \frac{[\text{NaCN}]}{[\text{HCN}]}$$

$$\Rightarrow 9.3 = 9.3 + \log \frac{[\text{NaCN}]}{[\text{HCN}]}$$

$$\Rightarrow \log \frac{[\text{NaCN}]}{[\text{HCN}]} = 0$$

$$\frac{[\text{NaCN}]}{[\text{HCN}]} = 1$$

**26. Answer: 3****Sol:**

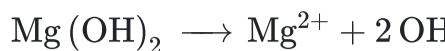
$$S' = \frac{K_{SP}}{2C}$$

$$= \frac{4 \times 10^{-10}}{2 \times 4 \times 10^{-2}}$$

$$= 0.5 \times 10^{-8}$$

$$= 5 \times 10^{-9}$$

**Sol:**



$$\begin{array}{ccccccc} 1 & & - & & - \\ 1-x & & x & & x \end{array}$$

$$K_{sp} = [\text{Mg}^{2+}] [\text{OH}^-]^2$$

$$= x \times (2x)^2$$

$$= 4x^3$$

$$4x^3 = 4 \times 10^{-12}$$

$$x = 1 \times 10^{-4}$$

$$2x = 2 \times 10^{-4}$$

$$\text{Also, } p\text{OH} = -\log [\text{OH}^-]$$

$$= 4 - \log 2$$

$$\text{pH} = 14 - \text{pOH}$$

$$= 14 - 4 + \log 2$$

$$\text{pH} = 10 + \log 2$$

**27. Answer: 2**

**Sol:**

According to the Bronsted Lowry concept, acids are those species that can donate  $\text{H}^+$ .

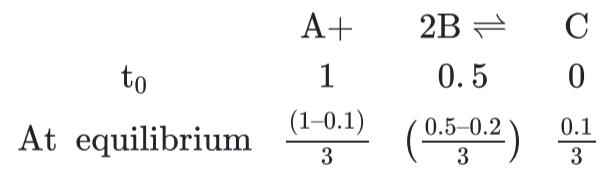
Option (A), (C), (D) doesn't have  $\text{H}^+$  to donate.

Only  $\text{H}_3\text{O}^+$  has a tendency to donate  $\text{H}^+$ .

**29. Answer: 1**

**Sol:**

The given reaction is :



$$K_C = \frac{[\text{C}]}{[\text{A}][\text{B}]^2} = \frac{\frac{0.1}{3}}{\frac{0.9}{3} \times \left(\frac{0.3}{3}\right)^2} = \frac{100}{9} = 11.1$$

**28. Answer: 3**

**Sol:**

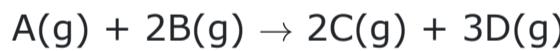
$[\text{H}^+]$  in monobasic acid = molarity  $\times$  degree of ionisation

$$= 0.1 \times \frac{2}{100} = 2 \times 10^{-3} \text{ M}$$

$$[\text{OH}^-] = \frac{K_w}{[\text{H}^+]} = \frac{1 \times 10^{-14}}{2 \times 10^{-3}} = 5 \times 10^{-12} \text{ M}$$

**30. Answer: 4**

**Sol:**



$$\Delta g = 5 - 3 = 2$$

Given,  $\Delta H = 19 \text{ K cal}$

$$T = 27 + 273$$

Using,  $= 300 \text{ K}$

$$\Delta H = \Delta E + \Delta n_g RT$$

$$19 = \Delta E + \frac{2 \times 2 \times 300}{1000}$$

$$19 = \Delta E + 1.2$$

$$\Delta E = 17.8 \text{ Kcal.}$$

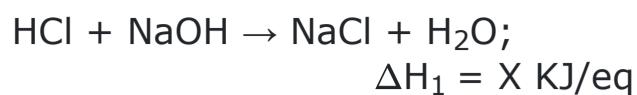
**31. Answer: 2**

**Sol:**

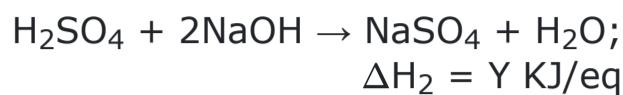
Correct explanation- Ionization equilibrium  $\text{H}_2\text{S} \rightleftharpoons 2\text{H}^+ + \text{S}^{2-}$  is suppressed due to common ion effect

**32. Answer: 4**

**Sol:**



$$X \text{ KJ/eq} \quad \dots(1)$$



$$Y \text{ KJ/eq} \quad \dots(2)$$

Since, equation (ii) is twice of equation (i)

So, the relationship between enthalpies;

$$2X = Y$$

$$X = Y/2$$

$$\boxed{X = 0.5 Y}$$

### 33. Answer: 2

**Sol:**

Find solubility for each separately by  $S^2 = K_{SP}$  for MnS and ZnS.  $108 S^5 = K_{SP}$  for  $\text{Bi}_2\text{S}_3$  and  $4 S^3 = K_{SP}$  for  $\text{Ag}_2\text{S}$ .

### 34. Answer: 4

**Sol:**

$$\Delta G = \Delta H - T \Delta S$$

For spontaneous  $\Delta G = (-)$  ve

$$(i) \Delta H = (+) \text{ ve} \quad \Delta S = (+) \text{ ve}$$

$$\Delta G = (+) \text{ ve} - (+) \text{ ve} \quad (T \Delta S > \Delta H)$$

$\Delta G = (-)$  ve Spontaneous reaction

$$(ii) \Delta H = (-) \text{ ve}, \Delta S = (-) \text{ ve} \quad (\Delta H > T \Delta S)$$

$$\Delta G = (-) \text{ ve} - (-) \text{ ve}$$

$(-)$  ve Spontaneous

$$(iii) \Delta H = (-) \text{ ve}, \Delta S = (+) \text{ ve}$$

$$\Delta G = (-) \text{ ve} - (+) \text{ ve}$$

$\Delta G = (-)$  ve Spontaneous

$$(iv) \Delta H = (+) \text{ ve} \quad \Delta S = (-) \text{ ve}$$

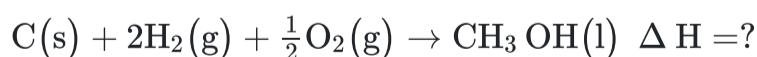
$$\Delta G = (+) \text{ ve} - (-) \text{ ve}$$

$\Delta G = (+)$  ve  $\rightarrow$  nonSpontaneous

### 35. Answer: 1

**Sol:**

Target equation:



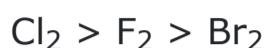
$$\Delta H = (-393 - 2 \times 286) - (-726)$$

$$= -393 - 572 + 726$$

$$= -239 \text{ kJmol}^{-1}$$

**36. Answer: 2****Sol:**

We know, as move down the group from top to bottom electron affinity decreases but F has low electron affinity than Cl because F has small in size. Therefore order of EA:-

**37. Answer: 1****Sol:**

Order is donate lone pair :  $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$

$\text{NH}_3$  is donated easily lone pair due to its small size as the electron density of the electron pair is concentrated over a small region

**39. Answer: 1****Sol:**

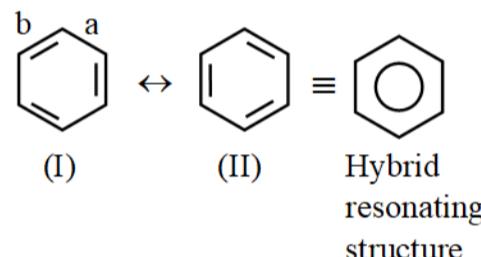
- (a)  $-X \Rightarrow +M$  and  $-I$
- (b)  $-\text{COO}^- \Rightarrow -M$  and  $+I$
- (c)  $-\text{CN} \Rightarrow -M$  and  $-I$
- (d)  $-\overset{\ominus}{\text{NH}} \Rightarrow +M$  and  $+I$

**41. Answer: 2****Sol:**

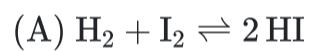
- (a) Inductive effect – Partial displacement of  $\sigma e^-$  and Permanent effect
- (b) Resonance – Complete displacement of  $\pi e^-$  and Permanent effect
- (c) Hyper conjugation – Complete displacement of  $\sigma e^-$  and Permanent effect
- (d) Electromeric effect – Complete displacement of  $\pi e^-$  and Temporary effect

**43. Answer: 1****38. Answer: 3****Sol:**

The poor shielding effect of d-electrons in gallium increases the effective nuclear charge experienced by the valence electrons. This results in a decrease in atomic size.

**40. Answer: 3****Sol:**

Stability I=II

**42. Answer: 2****Sol:**

$$\Delta n = 0$$

$$K_p = K_c$$

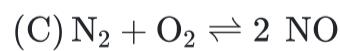


$$\Delta n = 2 - (1 + 3) = -2$$

we know

$$K_p = K_c \times (RT)^{-2}$$

$$[K_c > K_p]$$



$$\Delta n = 2 - (1 + 1) = 0$$

$$K_p = K_c$$



$$\Delta H = (2 - 2) = 0$$

$$K_p = K_c$$

**44. Answer: 2**

**Sol:**



$$t = 0 \quad a \quad 0$$

$$\text{at eq.} \quad a - x \quad x$$

$$K_C = 0.0414 = \frac{\left(\frac{x}{1}\right)\left(\frac{x}{1}\right)}{\left(\frac{a-x}{1}\right)}$$

$$x = 0.1 \text{ mol}$$

$$= \frac{\left(\frac{0.1}{1}\right)\left(\frac{0.1}{1}\right)}{\frac{a-0.1}{1}}$$

$$= \frac{(0.1)^2}{a-0.1}$$

$$= \frac{1}{a-0.1} = 0.0414 \times 100$$

$$\frac{1}{a-0.1} = 4.14$$

$$a - 0.1 = \frac{1}{4.14}$$

$$a = 0.2415 + 0.1$$

$$= 0.3415$$

**45. Answer: 2**

**Sol:**

For 1 mole of combustion of benzene

$$\Delta n_g = -1.5$$

$$\Delta H = \Delta U + \Delta n_g RT$$

$$\Rightarrow -3271 = \Delta U - \frac{1.5 \times 8.314 \times 300}{1000}$$

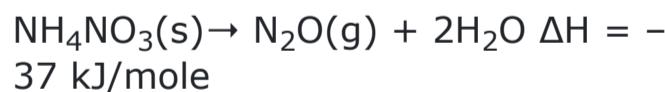
$$\Rightarrow \Delta U = -3267.25 \text{ KJ}$$

For 1.5 mole of combustion of benzene

$$\Delta U = -3267.25 \times 1.5 = -4900.88 \text{ KJ}$$

**47. Answer: 3**

**Sol:**



$$\text{mol wt. of NH}_4\text{NO}_3 = 80$$

Energy released from combustion of 80 g/mol

$$= -37 \text{ kJ/mole}$$

$$2.5 \text{ gm} = \frac{37}{80} \times 2.5 = 1.16 \text{ kJ}$$

**49. Answer: 4**

**Sol:**

$$\Delta G^\circ = -2.303RT \log K_P$$

$$= -2.303 \times 2 \times 300 \times \log 10^{-3} \text{ cal}$$

$$= 4145.4 \text{ cal} = 4.1454 \text{ kcal}$$

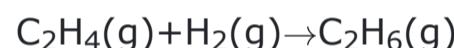
**Sol:**

$$q = n \cdot C \cdot \Delta T = \frac{100}{18} \times 75 \times \Delta T = 10^3$$

$$\therefore \Delta T = 2.4 \text{ K}$$

**46. Answer: 1**

**Sol:**



$$\Delta_r H = \sum \text{BE}_R - \sum \text{BE}_P$$

$$= \text{BE}_{\text{C}=\text{C}} + 4\text{BE}_{\text{C}-\text{H}} + \text{BE}_{\text{H}-\text{H}} - \text{BE}_{\text{C}-\text{C}} - 6\text{BE}_{\text{C}-\text{H}}$$

$$= 600 + 4 \times 410 + 400 - 350 - 6 \times 410$$

$$= -170 \text{ KJ/mol}$$

**48. Answer: 3**

**Sol:**

$$\Delta S = nC_{p,m} \ln \frac{T_2}{T_1}$$

$$= 2.5 \times 18 \times 4.2 \ln \left( \frac{360}{300} \right) = 34.02 \text{ K}$$

**50. Answer: 4**

**Sol:**

Here the concentration (C) = 0.1 M

and  $\alpha = 0.001\%$

Thus, the ionization constant  $K_a$  of the acid can be given as-

$$K_a = \frac{C\alpha^2}{1-\alpha}$$

$$K = \frac{C\alpha^2}{1-\alpha}$$

If it is ionized then the value  $\alpha$  is negligible

$$K = C\alpha^2$$

$$\text{concentration} = 0.1 \text{ m}$$

$$\text{Ionizes } \alpha = 0.001.1$$

$$\frac{0.001}{1 \times 1000}$$

$$\frac{1}{10^{-5}}$$

$$= 10^{-5}$$

$$K = 0.1 \times \frac{1}{(10^{-5})^2}$$

$$K = \frac{0.1}{10} \times \frac{1}{10^{-10}}$$

$$K = 1 \times 10^{-11}$$

51. Answer: 3

**Sol:**

Prokaryotes are the primitive organism which lacks membrane-bounded organelles and nucleus. Prokaryotic cells have some microscopic structures in their cytoplasm. They serve specific purposes for the cell. Inclusions are aggregates of specific chemical compounds and often serve as a reservoir of energy or carbon. Common inclusions are polyhydroxyalkanoate, sulfur globules, cyanophycin globules, and polyphosphate. Polyribosomes (or polysomes) also known as ergosomes are a cluster of ribosomes, bound to the mRNA molecule during translation process found in the eukaryotes.

52. Answer: 1

**Sol:**

Photophosphorylation is the process in which light energy is converted into chemical energy through production of ATP.

It is the process of formation of ATP from ADP and inorganic phosphate (ip) utilising light energy.

The flow of electrons through ETS is linked to photophosphorylation. Electron transport chain is a series of electron carriers over which electrons pass in a downhill journey releasing energy at every step that is used in generating an electrochemical proton gradient which helps in synthesising ATP.

Based on path of electrons, associated photophosphorylation can be identified as non-cyclic and cyclic phosphorylation.

53. Answer: 2

**Sol:**

R plasmids, also known as resistance plasmids, are the cause of drug resistance.

**Sex factor plasmids:** The cell that possesses this plasmid is called F<sup>+</sup>, or male, or the donor cell, while the cells that do not possess this plasmid are called F<sup>-</sup>, or the recipient cell.

55. Answer: 1

**Sol:**

**Ribosomes** are **non-membrane bound** organelles found in all cells – both **eukaryotic as well as prokaryotic**. Within the cell, ribosomes are found not only **in the cytoplasm** but also within the **two organelles – chloroplasts** (in plants) and **mitochondria** and on rough ER.

57. Answer: 3

54. Answer: 1

**Sol:**

Both ATP and NADPH + H<sup>+</sup> are formed in the direction of the stroma. It is a light-dependent reaction and occurs in **the grana in the thylakoid membrane**, in which the formation of ATP and NADPH takes place along with other substances.

56. Answer: 3

**Sol:**

**Moll's half-leaf experiment** proves that CO<sub>2</sub> is essential for photosynthesis. A part of the leaf is enclosed in a test tube containing **KOH-absorbable** cotton. KOH absorbs CO<sub>2</sub>, while the other half is exposed to air. This setup is placed under light for some time, and a starch test is carried out. The half portion inside the tube tested negative for starch as there was no CO<sub>2</sub>, which is required for photosynthesis.

58. Answer: 4

**Sol:**

Robert Brown discovered the nucleus and not the cell.

The cell was first observed by Robert Hooke when he was studying the cork cells of plants.

Metthias Schleiden and Theodore Schwann (1938) proposed the cell theory which was later modified by Rudolf Virchow (1855).

**Hence, the correct option is "3" - Robert brown discovered the cell.**

**59. Answer: 1****Sol:**

In C<sub>4</sub> plants, photorespiration does not occur because they have a mechanism that increases the concentration of CO<sub>2</sub> at the enzyme site. This takes place when the C<sub>4</sub> acid from the mesophyll is broken down in the bundle sheath cells to release CO<sub>2</sub>. This results in an increase in the intracellular concentration of CO<sub>2</sub>.

Hence, both assertion and reason are correct, and reason is the correct explanation for assertion.

**61. Answer: 1****Sol:**

Lysosomes were discovered by Christian de Duve (1955) from rat liver. Matile (1964) discovered lysosomes in plants. Generally lysosomes are 0.2 - 0.8 in size, irregular membranous vesicles filled with hydrolytic enzymes. They are polymorphic. About 40 enzymes (all hydrolytic) are present in lysosomes. These include proteases, nucleases, glycosidases, lipases, phospholipases, phosphatases and sulfatases.

**63. Answer: 3****Sol:**

The proteins synthesized by the ribosomes bound to ER are passed into the lumen of ER where an oligosaccharide is added to them (i.e., these are glycosylated).

**65. Answer: 3****Sol:**

Photorespiration is a wasteful process, It occurs in C<sub>3</sub> plants. It happens due to oxygenase activity of RuBisCO.

Due to oxygenase activity of RuBisCO, oxygen is fixed in place of carbon dioxide in the first reaction of calvin cycle . For that reason the RuBP instead of being converted to 2 molecules of phosphoglyceric acid (PGA) binds with O<sub>2</sub> to form one molecule of PGA (phosphoglycerate) and phosphoglycolate.

**Hence, the correct answer is option "4" - Oxygenase.**

**60. Answer: 2****Sol:**

contains ribosomes

**62. Answer: 2****Sol:**

Photosynthesis is under the influence of both external and internal factors. The internal factors include chlorophyll content of leaves, protoplasmic factor, accumulation of by-products, leaf anatomy, age of the leaf and hormones and the external factors include sunlight, temperature, carbon dioxide concentration and water.

At lower light intensities, light is the limiting factor because an increase in light causes an increase in photosynthesis. An increased level of carbon dioxide leads to a higher rate of photosynthesis when compared to the lower carbon dioxide level.

**64. Answer: 2****Sol:**

The **three-carbon pyruvic acid** molecules are converted to a **two-carbon** molecule attached to **Coenzyme A**, called **acetyl CoA**, via the process of **pyruvate oxidation**. It is the product, acetyl CoA, that **enters the Krebs cycle**.

**66. Answer: 2**

**Sol:**

Tonoplast is the membrane surrounding the vacuole. The vacuole helps in maintaining cell volume and cell turgor; the regulation of cytoplasmic ions and pH. The tonoplast helps in the transport of ion and minerals against the concentration gradient into the vacuole utilizing energy in the form of ATP.

**67. Answer: 4****Sol:**

Golgi apparatus remains in close association with the endoplasmic reticulum. Reason: A number of proteins synthesised by ribosomes on the ER are modified in the cisternae of the GM before they are released from the trans face.

Golgi apparatus remains in close association with endoplasmic reticulum. Materials to be packaged in the form of vesicles from ER fuse with cis face of the golgi apparatus and move towards maturing face.

**69. Answer: 3****Sol:**

Lysosomes are membrane-bound vesicular structures formed by the process of packaging in the golgi apparatus. These are very rich in almost all types of hydrolytic enzymes (hydrolases – lipases, proteases, carbohydrates).

These enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids.

**71. Answer: 4****Sol:**

Acetyl-CoA can be formed from the oxidative decarboxylation through glycolysis.

It can also be formed through oxidation of fatty acids, and oxidative degradation of amino acids.

**Hence, the correct answer is option "2" - Carbohydrates, fats, amino acids.**

**68. Answer: 1****Sol:**

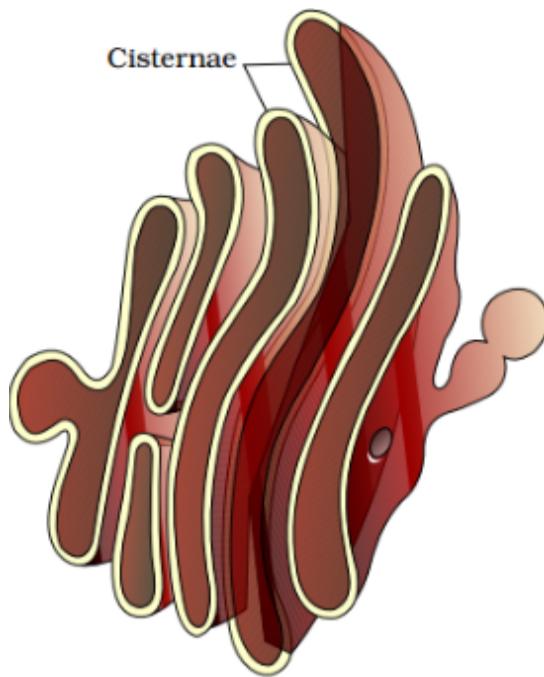
In **glycolysis**, there is a net gain of **2 ATPs**. The **TCA cycle** generates **two ATPs** for every glucose molecule (2 acetyl CoA).

**70. Answer: 4****Sol:**

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**72. Answer: 2**

**Sol:**

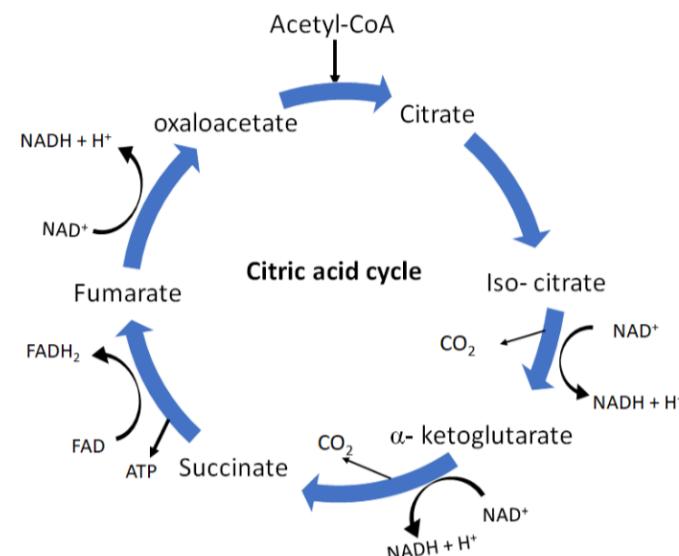


The Golgi apparatus is an organelle that is made up of concentrically arranged Golgi cisternae that have distinct convex cis (forming) and concave trans (maturing) faces.

**Sol:**

Oxidative decarboxylation reactions are oxidation reactions in which a carboxylate group is removed, forming carbon dioxide. They often occur in biological systems: there are many examples in the citric acid cycle.

Oxidative decarboxylation occurs during the oxidation of pyruvate to acetyl-CoA, during conversion of oxaloacetate from isocitrate and formation of succinyl-CoA from  $\alpha$ -ketoglutarate in the Krebs cycle. Each pyruvate molecule loses a carboxylic group in the form of  $\text{CO}_2$  the remaining carbon are then transferred to the enzyme CoA to produce Acetyl CoA.



**73. Answer: 1**

**Sol:**

A granum is a stack of thylakoid discs. Chloroplasts can have from 10 to 100 grana. Grana are connected by stroma thylakoids, also called intergranal thylakoids or lamellae. Grana thylakoids and stroma thylakoids can be distinguished by their different protein composition.

**75. Answer: 2**

**Sol:**

Endomitosis

**74. Answer: 2**

**Sol:**

Electron transport chain

**76. Answer: 1**

**Sol:**

A single grain of maize, the root apical meristem can give rise to more than 17,500 new cells per hour, whereas cells in a watermelon may increase in size by up to 3,50,000 times. In the former, growth is expressed as an increase in cell number; in the latter, growth is expressed as an increase in cell size. While the growth of a pollen tube is measured in terms of its length, an increase in surface area denotes the growth of a dorsiventral leaf.

**77. Answer: 2**

**78. Answer: 3**

**Sol:**

The prophase I of meiosis I is marked by synapsis of homologous chromosomes and crossing over. Zygote of prophase I chromosomes start pairing together and this process of association is called synapsis. Such paired chromosomes are called homologous chromosomes. Electron micrographs of this stage indicate that chromosome synapsis is accompanied by the formation of complex structure called synaptonemal complex. The complex formed by a pair of synapsed homologous chromosomes is called a bivalent or a tetrad.

**79. Answer: 1****Sol:**

A higher concentration of ethylene is found in ripening banana. A higher concentration of ethylene is found in ripening banana. For ripening of any fruit or vegetable they need good concentration of ethylene in them. Hence now a days artificially raw fruits are exposed to ethylene compounds to make them ripen faster.

**81. Answer: 3****Sol:**

**Gibberellins (Gibberellic Acids)** are plant hormones that control, among other things, **stem elongation, germination, dormancy, flowering, floral development, and leaf and fruit senescence**. Gibberellin spraying on juvenile conifers **accelerates maturity, resulting in early seed production**.

**83. Answer: 3****Sol:**

NAA (naphthalene acetic acid) and 2,4-D (2,4-dichlorophenoxyacetic acid) are synthetic auxins. All these auxins have been used extensively in agricultural and horticultural practices. They are widely used as herbicides.

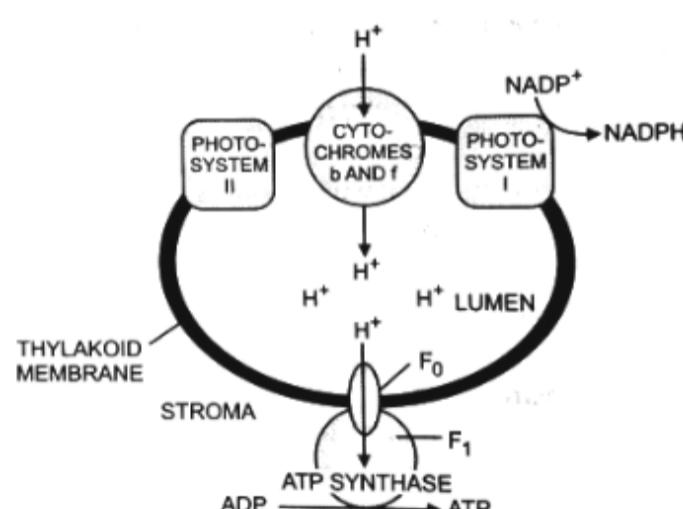
**80. Answer: 3****Sol:**

Auxin helps in stem elongation and inhibits the growth of lateral buds for maintaining the apical dominance. This hormone helps in promoting growth and repairing wounds in plants in stem tips, buds, and in root tips.

Cytokinin helps in stimulating mitosis process that helps in plant growth and in the formation of shoots and buds by increasing cell division.

Cytokinin helps in sprouting of lateral buds and auxin inhibits the growth of lateral buds that helps in maintaining apical dominance.

**Hence, the correct answer is option "3" - Growth of lateral buds.**

**82. Answer: 2****Sol:**

In chloroplast proton gradient formation occurs in lumen.

**84. Answer: 3**

**Sol:**

The **thick-walled bundle sheath cells present around vascular bundles** in the **shape of a ring** in C<sub>4</sub> Plants have **chloroplasts**. This special arrangement of cells and the presence of **dimorphic chloroplasts help minimise photorespiration in C<sub>4</sub> plants**. The **bundle sheath cells have agranal chloroplasts** and fix carbon dioxide with the help of the **RuBisCO** enzyme.

**85. Answer: 4****Sol:**

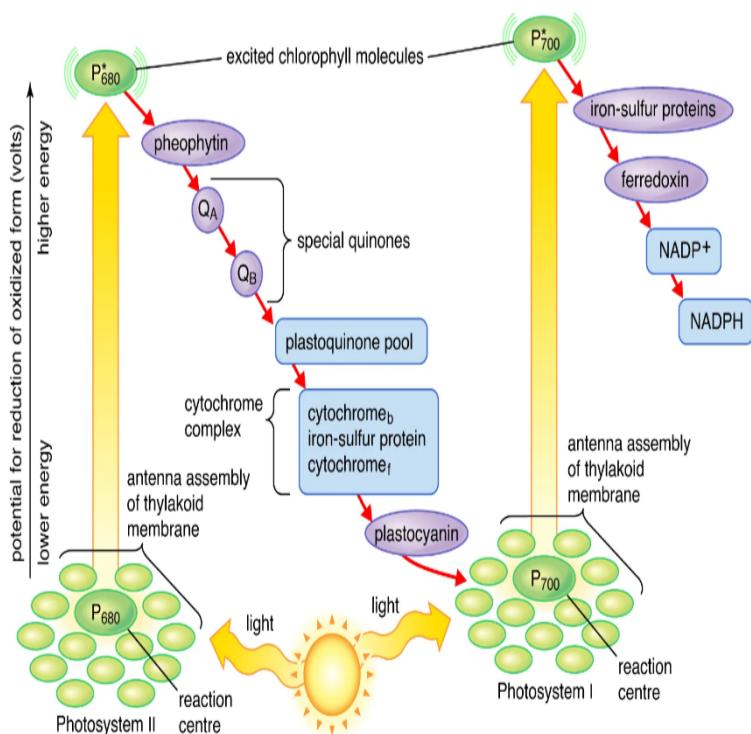
In cyclic electron transfer, electrons are removed from an excited chlorophyll molecule, passed through an electron transport chain to a proton pump, and then returned to the chlorophyll. The mobile electron carriers are, as usual, a lipid-soluble quinone and a water-soluble cytochrome.

When only PS-I is functional, the electron is circulated within the photosystem and the phosphorylation occurs due to cyclic flow of electrons.

A possible location where this could be happening is in the stroma lamellae.

All three option are true regarding cyclic electron transfer system (ETS) in higher plants. But last option is incorrect because

No External electron donor is required.

**Sol:**

Ubiquinone is the pro-oxidant or the mobile component of the mitochondrial electron transport chain.

It is also known as Coenzyme - Q, present within the inner membrane.

Hence, the correct answer is option "3" - Within Inner Membrane.

**86. Answer: 3**

**Sol:**

Absence of replication of DNA

**87. Answer: 4**

**Sol:**

M phase is known as mitotic phase and cell division occurs in this phase. The reformation of the nuclear envelope during M-phase of the cell cycle takes place during telophase. The nuclear membrane which disappears during prophase reappears in the telophase. But before it is reformed the nucleus gets reorganised by decondensation from chromosome and reassembly of the nuclear lamina.

**88. Answer: 4**

**Sol:**

Meiosis is the mechanism by which conservation of specific chromosome number of each species is achieved across generations in sexually reproducing organisms, even though the process, per se, paradoxically, results in reduction of chromosome number by half. It also increases the genetic variability in the population of organisms from one generation to the next. Variations are very important for the process of evolution.

Mitosis is a process where a single cell divides into two identical daughter cells (cell division).

Multiple fission is the process of asexual reproduction in which instead of 2 daughter cells, many daughter cells are produced from the parent cell.

Fragmentation, also known as splitting, is a form of asexual reproduction in which an organism splits into fragments. Each fragment develops into a mature clone genetically and morphologically identical to its parent. It is a type of asexual reproduction or vegetative propagation.

**89. Answer: 2**

**Sol:**

At the onset of anaphase, each chromosome arranged at the metaphase plate is split simultaneously and the two daughter chromatids, now referred to as chromosomes of the future daughter nuclei, begin their migration towards the two opposite poles. As each chromosome moves away from the equatorial plate, the centromere of each chromosome is towards the pole and hence at the leading edge, with the arms of the chromosome trailing behind. Thus, anaphase stage is characterised by the following key events: Centromeres split and chromatids separate. Chromatids move to opposite poles.

**91. Answer: 3**

**90. Answer: 4**

**Sol:**

$G_2$  phase follows mitotic phase

**92. Answer: 4**

**Sol:**

M phase represents the phase in which the actual cell division occurs. During mitosis, the chromosomes containing two chromatids each with one DNA molecule splits into two separate chromatids, and each chromatid behaves as a future daughter chromosome.

At the end of the M phase, both daughter cells formed contain an equal number of chromosomes as was present in the parent cell.

The number of chromosomes per cell at the beginning of the M phase = 16. The number of chromosomes after the M phase (here, mitosis) per daughter cell = 16. Final Answer: Onion is diploid with 16 chromosomes.

During the cell cycle, the number of chromosomes at G<sub>1</sub> and after S are 16 each. Also, after the M phase (after mitotic cell division), the number of chromosomes in each daughter cell is 16.

**93. Answer: 3****Sol:**

5 Carbon compound is the acceptor of CO<sub>2</sub> in C<sub>3</sub> cycle.

PEP carboxylase catalyzes carboxylation of phosphoenolpyruvate (PEP, the primary acceptor of CO<sub>2</sub>) to form four carbon compound oxaloacetate in mesophyll cells of C<sub>4</sub> plants.

OAA is converted into malic acid which enters bundle sheath cells and undergoes decarboxylation. In C<sub>3</sub> cycle, RUBISCO catalyzes carboxylation of CO<sub>2</sub> ribulose 1,5-bisphosphate (RuBP), the primary carbon acceptor.

**95. Answer: 2****Sol:**

The term "**glycolysis**" has its origins in two Greek words: "**glycos**," which means **sugar**, and "**lysis**," which means **splitting**. that indicates the process of **splitting of sugar (glucose)**.

**97. Answer: 3****Sol:**

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**99. Answer: 1****Sol:**

The protons taken up by the reduced plastoquinone pool are translocated together with the electrons through the pool from the outside to the inside of the membrane. Therefore, **the plastoquinone pool might act as a pump for a vectorial hydrogen (H<sup>+</sup> + e<sup>-</sup>) transport.**

**94. Answer: 2****Sol:**

If several factors affect any [bio] chemical process, Blackman's (1905) Law of Limiting Factors comes into effect. This states the following: If a chemical process is affected by more than one factor, then its rate will be determined by the factor which is nearest to its minimal value: it is the factor which directly affects the process if its quantity is changed.

For example, despite the presence of a green leaf and optimal light and CO<sub>2</sub> conditions, the plant may not photosynthesise if the temperature is very low. This leaf, if given the optimal temperature, will start photosynthesising.

**96. Answer: 3****Sol:**

Kerbs' cycle produces 2 GTP (or 2 ATP) through substrate level phosphorylation. Six molecules of NADH<sub>2</sub> and 2 molecules of FADH<sub>2</sub> for every two molecules of Acetyl CoA are oxidized by it.

**98. Answer: 1****Sol:**

The diagram shows germinating beans. Beans take just 7 to 14 days to seed germinate in the soil at 60 to 85°F soil.

**100. Answer: 3**

**Sol:**

Senescence is an active genetically controlled developmental process in which cellular structure and macromolecules are broken down and translocated away from the senescent organ (typical leaves) to actively growing reason that serve as nutrient sinks. Senescence is initiated by environmental cues and is regulated by the hormones e.g., ABA (Abscisic Acid). Higher amounts of ABA stops protein and RNA synthesis and accelerating the senescence.

**Sol:**

**(A)** is true statement but **(R)** is false.

**101. Answer: 4**

**Sol:**

Neither neurotransmitter is released nor the  $\text{Na}^+$  channels of post-synaptic neuron open up.

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**103. Answer: 3**

**Sol:**

Class 11<sup>th</sup> NCERT Page No. 231

**105. Answer: 1**

**Sol:**

Multipolar Neurons (with one axon and two or more dendrites; found in the cerebral cortex).

Bipolar (with one axon and one dendrite, found in the retina of eye).

Myelinated nerve fibres - found in spinal and cranial nerves.

Unmyelinated nerve fibres - found in autonomous and the somatic neural system.

**107. Answer: 1**

**102. Answer: 2**

**Sol:**

Pons

**104. Answer: 1**

**Sol:**

Both **statement I** and **statement II** are incorrect

**106. Answer: 2**

**Sol:**

Corpora quadrigemina is part of posterior surface of the adult midbrain. It is characterized by four elevations. The limbic system is a collection of structures involved in processing emotion and memory, including the hippocampus, the amygdala, and the hypothalamus.

**108. Answer: 3**

**Sol:**

**Impulse transmission** across an **electrical synapse** is always faster than that across a **chemical synapse**.

- Chemical synapses use **chemicals** for transmission which are known as **neurotransmitters**.
- The membranes of **presynaptic and postsynaptic** neurons are in close proximity in an **electrical synapse**.
- In an electrical synapse, the transmission of the impulse occurs in the form of an electrical current from **one neuron to the next neuron**.

**Sol:**

**Correct statements**

- a. The neural organisation is very simple in lower invertebrates. For example, in Hydra it is composed of a network of neurons.
- d. Nissl's granules are fragments of rough endoplasmic reticulum (RER). They are involved in protein synthesis and are found only in specific parts of the neuron; in the cyton as well as the dendrites. They are absent in axon.

**Incorrect statements**

- b. Efferent nerve fibres conduct nerve impulses from the CNS to the effector organs such as muscles and glands.
- c. Somatic neural system is responsible for the voluntary control of the body. It transmits impulses from the CNS to the skeletal muscles. Autonomic neural system transmits impulses from CNS to involuntary organs and smooth muscles.
- e. Myelinated nerve fibres are those enclosed by Schwann cells which form myelin sheath around the axon. While, Unmyelinated nerve fibres are those enclosed by Schwann cells however these Schwann cells do not synthesize myelin sheath around the axon.

**109. Answer: 4**

**Sol:**

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**110. Answer: 3**

**Sol:**

Class 11<sup>th</sup> NCERT Page No. 221

**111. Answer: 2**

**Sol:**

Class 11<sup>th</sup> NCERT Page No. 219

**112. Answer: 4**

**Sol:**

In a resting state, the edges of thin filaments on either side of the thick filaments partially overlap the free ends of the thick filaments leaving the central part of the thick filaments.

This central part of thick filament, not overlapped by thin filaments is called the 'H' zone.

Hence correct option is D

**113. Answer: 3**

**114. Answer: 3**

**Sol:**

Ciliary movement occurs in most of our internal tubular organs which are lined by **ciliated** epithelium. The coordinated movement of cilia in the **trachea** help us in removing dust particles. Passage of ova through female reproductive tract is facilitated by the **ciliary** movement.

**Sol:**

The correct sequence of the muscle contraction is given as follows.

The stimuli neurotransmitter secretion occurs leads to the exploitation of T-system.

The calcium + 2 ions are released from the binding site which removes the mask of the active sites for myosin. · The myosin head then binds to the actin binding sites to form a cross bridge by using the energy from ATP hydrolysis.

This then pulls the actin filaments which is attached to the myosin towards the center band. ·

The Z lines which is attached to the actors are again pulled inward causes the contraction. The H band then reduces and the A band retains its length.

**115. Answer: 1****Sol:**

Increase in  $\text{Ca}^{++}$  level leads to the binding of calcium with a subunit of troponin on actin filaments and thereby remove the masking of active sites for myosin. Utilising the energy from ATP hydrolysis, the myosin head now binds to the exposed active sites on actin to form a cross bridge.

This pulls the attached actin filaments towards the centre of 'A' band. The 'Z' line attached to these actins are also pulled inwards towards M line thereby causing a shortening of the sarcomere, i.e., contraction.

During shortening of the muscle (contraction). the I bands get reduced, whereas the 'A' bands retain the length.

**117. Answer: 3****Sol:**

Amount of sarcoplasmic reticulum is low

**119. Answer: 2****Sol:**

Statement I correct and II incorrect

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**116. Answer: 2****Sol:**

11<sup>th</sup> NCERT Page No. 226,227

**118. Answer: 3****Sol:**

Class 11<sup>th</sup> NCERT Page No. 208

**120. Answer: 3****Sol:**

a. **ADH** facilitates water **reabsorption from latter parts** of the tubule, thereby preventing diuresis.

b. **Dialysis** fluid contains all the constituents of the plasma except urea. Urea is the main **nitrogenous waste** of the body and in case of kidney failure, this gets accumulated in the blood.

c. A healthy adult human excretes (on an average) 25-30 gm of urea/day.

**121. Answer: 2****122. Answer: 4**

**Sol:**

Both **(A)** and **(R)** are true but **(R)** is not the correct explanation of **(A)**

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**Sol:**

In counter current mechanism, NaCl is transported by the ascending limb of **Henle's loop** which is exchanged with the descending limb of vasa recta. NaCl is returned to the interstitium by the ascending portion of **vasa recta**.

**123. Answer: 4****Sol:**

**Hormone** – Aldosterone, **Source** – Adrenal cortex, **Functions**–Stimulates reabsorption of Na<sup>+</sup> and water from DCT

**125. Answer: 2****Sol:**

Diabetes mellitus leads to a complex disorder called prolonged hyperglycemia, which is associated with the loss of glucose through urine known as **glycosuria**.

When the cell are unable to utilize carbohydrates for energy instead they use fats & proteins. This fat degradation produces ketone bodies. The presence of these ketone bodies in urine is known as **ketonuria**.

Thus, presence of **Ketonuria and Glycosuria** in urine are indicative of Diabetes Mellitus.

**127. Answer: 2****Sol:**

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**129. Answer: 3****Sol:**

**Class XI NCERT Page No. 245, 246**

**131. Answer: 1****Sol:**

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**133. Answer: 4****124. Answer: 3****Sol:**

**Class XI<sup>th</sup> NCERT Page No. 212**

**126. Answer: 1****Sol:**

11th NCERT, Pg- 298

**128. Answer: 1****Sol:**

11th NCERT, Pg- 336

**130. Answer: 4****Sol:**

11th, NCERT, PAGE NO.- 336

**132. Answer: 3****Sol:**

Class 11<sup>th</sup> NCERT Page No. 231

**134. Answer: 4****Sol:**

The pineal gland is located on the dorsal side of forebrain. Pineal secretes a hormone called melatonin. Melatonin plays a very important role in the regulation of a 24-hour (diurnal) rhythm of our body. For example, it helps in maintaining the normal rhythms of sleep-wake cycle, body temperature. In addition, melatonin also influences metabolism, pigmentation, the menstrual cycle as well as our defense capability.

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**Sol:**

Cortisol and testosterone are lipid soluble hormones, which can directly pass through the cell membrane of the target cell and bind with intracellular receptors. Steroid hormones can pass through the membrane very easily and also bind to the receptor present inside the nucleus.

The hormones that cannot easily be passed through the membrane are peptide hormones. These are insoluble hormones.

Cortisol is a steroid hormone secreted from the adrenal cortex and testosterone is also a steroid hormone secreted by the testes.

**135. Answer: 3****Sol:**

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**136. Answer: 3**

**Sol:**

11, NCERT, Pg- 317, 318, 319

**Resting potential-** The electrical potential difference across the resting plasma membrane.

**Nerve impulse** - The electrical potential difference across the plasma membrane at the site is called the action potential or nerve impulse.

**Synaptic cleft** -At a chemical synapse, the membranes of the pre- and post-synaptic neurons are separated by a fluid-filled space called synaptic cleft.

**Neurotransmitters**- Chemicals called neurotransmitters are involved in the transmission of impulses at these synapses.

**137. Answer: 3**

**Sol:**

**Class 11th NCERT Page No. 236**

**139. Answer: 4**

**Sol:**

A current flows on the inner surface from site A to site B.

On the outer surface, current flows from site B to site A to complete the circuit of current flow. Hence, the polarity at the site is reversed, and an action potential is generated at site B.

Thus, the impulse (action potential) generated at site A arrives at site B. The sequence is repeated along the length of the axon and consequently, the impulse is conducted.

**138. Answer: 2**

**Sol:**

Both statements I and II are incorrect.

**140. Answer: 3**

**Sol:**

Tetany is a muscular disorder that causes rapid spasms in muscles, which occur due to less calcium in body fluid.

Osteoporosis is a bone disease that develops when bone mineral density and bone mass decreases.

Muscular dystrophy is a genetic disorder which causes progressive weakness in skeletal muscles.

Arthritis is inflammation of one or more joints.

Myasthenia gravis is an autoimmune disease, which normally protects the body from foreign organisms and weakens skeletal muscles.

**141. Answer: 3**

**Sol:**

Hyoid bone is a part of skull but not part of cranium

Ribs has two articulation surfaces on its DORSAL ends and hence called bicephalic.

**142. Answer: 2**

**Sol:**

Both **(A)** and **(R)** are true but **(R)** is not the correct explanation of **(A)**

**143. Answer: 3**

**144. Answer: 3**

**Sol:**

**Class XI<sup>th</sup> NCERT Page No. 209**

**Sol:**

Dialysis is a process of removing waste products and excess fluid from the body. The steps of dialysis are:

Blood is drained from convenient artery.

Blood is mixed with heparin.

Blood is passed through a coiled and porous cellophane tube bathing in dialysis fluid.

Removal of nitrogenous waste from blood.

Blood is mixed with anti-heparin.

Blood is passed into a vein.

**145. Answer: 3****Sol:**

**(A)** is true statement but **(R)** is false.

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**146. Answer: 4****Sol:**

**PCT** : It is a primary site of glucose and amino acid reabsorption.

**Distal Convolute Tubule (DCT)** : It helps in selective secretion of hydrogen and potassium ions and  $\text{NH}_3$  to maintain the pH and sodium-potassium balance in blood.

**Descending limb** : The major substance reabsorbed here is water by osmosis.

**Ascending limb** : Sodium and water is reabsorbed actively in this region.

**147. Answer: 3****Sol:**

Class XI<sup>th</sup> NCERT Page No. 245, 246

**148. Answer: 4****Sol:**

A. The posterior pituitary is under the direct neural regulation of the hypothalamus.

B. Thyroid gland also secretes a protein hormone called thyrocalcitonin (TCT) which regulates the blood calcium levels.

C. Catecholamines also stimulate the breakdown of glycogen resulting in an increased concentration of glucose in blood.

D. Oxytocin and vasopressin, which are actually synthesised by the hypothalamus and are transported axonally to neurohypophysis.

**149. Answer: 1****150. Answer: 4****Sol:**

Class XI<sup>th</sup> NCERT Page No. 248

**Sol:**

Thyrocalcitonin & Parathormone have antagonistic effect on blood calcium level as thyrocalcitonin reduces  $\text{Ca}^{2+}$  level in blood and enhances the deposition of  $\text{Ca}^{2+}$  in bones while Parathormone increases the  $\text{Ca}^{2+}$  levels in the blood by stimulating the process of bone resorption and reabsorption of  $\text{Ca}^{2+}$  by the renal tubules.

**151. Answer: 3**

**Sol:**

$$Q_1 = Q_2 \Rightarrow m_{cu}S_{cu} \times \Delta\theta_1 = m_wS_w \times \Delta\theta_2$$

**153. Answer: 3**

**Sol:**

$$ml = mgh$$

Given  $\frac{1}{100}$ th part of 'm'

$$Kgh = \frac{mL}{100} \Rightarrow h = \frac{L}{100 \times g} = \frac{3.4 \times 10^5}{100 \times 10} = 336$$

**155. Answer: 3**

**Sol:**

For minimum value of m, the final temperature of the mixture must be  $0^\circ C$ .

So, from the principle of calorimetry,  
heat gained = heat released

$$\therefore 20 \times \frac{1}{2} \times 10 + 20 \times 80 = m \times 540 + m \times 100$$

$$\therefore m = \frac{1700}{640} = \frac{85}{32} \text{ gm}$$

**157. Answer: 3**

**Sol:**

Heat lost by water is gained by ice.

$$\text{Heat lost} = 10 \times 1 \times 10 = 100 \text{ cal}$$

$$\text{Heat gained} = 10 \times 1/2 \times 20 = 100 \text{ cal}$$

Thus the mixture contains 10 gm water and 10 gm ice both at  $0^\circ C$ .

**152. Answer: 1**

**Sol:**

$$K_0$$

**154. Answer: 1**

**Sol:**

$$t = \frac{\Delta\phi}{\omega} = \frac{\pi/2 - \pi/6}{2\pi/6} = \frac{(\pi/3)}{(\pi/3)} = 1 \text{ sec.}$$

**156. Answer: 2**

**Sol:**

$$T = 2\pi\sqrt{\frac{m}{k}}$$

**158. Answer: 2**

**Sol:**

We know that;

$$\text{Time period, } t = 2\pi\sqrt{\frac{\ell}{g}}$$

Where, t is the time period and g is the acceleration due to gravity

During free fall the body feels weightless inside the lift.

$$g = 0$$

$$\therefore \text{Time period, } t = 2\pi\sqrt{\frac{\ell}{0}}$$

$$= 2\pi\sqrt{\infty}$$

$$= \infty$$

Hence, the time period of a simple pendulum in a freely falling lift will be infinite.

**159. Answer: 1**

**160. Answer: 2**

**Sol:**

$$V_{max} = \omega A$$

$$\omega_p A_p = \omega_Q A_Q$$

$$\frac{A_p}{A_Q} = \frac{\omega_Q}{\omega_p} = \sqrt{\frac{K_2}{K_1}}$$

**Sol:**

$$\frac{52-36}{10} = k \left( \frac{52+36}{2} - 20 \right)$$

$$\Rightarrow \frac{16}{10} = k(44 - 20)$$

$$\Rightarrow \frac{8}{5} = k \times 24 \quad \dots\dots \text{(i)}$$

$$\text{Now, } \frac{36-T}{10} = k \left( \frac{36+T}{2} - 20 \right) \quad \dots\dots \text{(ii)}$$

$$\frac{\text{eqn.(i)}}{\text{eqn.(ii)}}$$

$$\frac{8}{5} \times \frac{10}{36-T} = \frac{24 \times 2}{36+T-40}$$

$$\frac{8}{36-T} = \frac{24}{T-4}$$

$$T \approx 28^\circ\text{C}$$

**161. Answer: 2**

**Sol:**

We know that

Explanation of the

$$V_{\text{rms}} = \sqrt{\frac{3k_B T}{m}}$$

$$V_{\text{rms}} = 1.73 \sqrt{\frac{k_B T}{m}} \quad \dots\dots \text{(1)}$$

$$V_{\text{av}} = \sqrt{\frac{8k_B T}{\pi m}}$$

$$V_{\text{av}} = 1.60 \sqrt{\frac{k_B T}{\pi m}} \quad \dots\dots \text{(2)}$$

$$V_{\text{mp}} = \sqrt{\frac{2k_B T}{m}}$$

$$V_{\text{mp}} = k 1.41 \sqrt{\frac{k_B T}{m}} \quad \dots\dots \text{(3)}$$

from these equation

$$V_{\text{rms}} > V_{\text{av}} > V_{\text{mp}}$$

**163. Answer: 1**

**Sol:**

We know from boyle's law that for a given mass of an ideal gas,  $pV = \text{const.}$  whatever may be the volume. graph A represent the correct behaviour of an ideal gas.

**162. Answer: 4**

**Sol:**

$$\text{Time for maximum to minimum} = \frac{T}{4}$$

$$5 = \frac{T}{4}$$

$$\therefore T = 20 \text{ s}$$

**164. Answer: 2**

**Sol:**

Equation of simple harmonic wave is

$$y = A \sin(\omega t + \phi)$$

$$\text{Here, } y = \frac{A}{2}$$

$$\therefore A \sin(\omega t + \phi) = \frac{A}{2}$$

$$\text{So, } \delta = \omega t + \phi = \frac{\pi}{6} \text{ or } \frac{5\pi}{6}$$

So, the phase difference of the particle when they are crossing each other at  $y = \frac{A}{2}$  in opposite directions are

$$\delta = \delta_1 - \delta_2$$

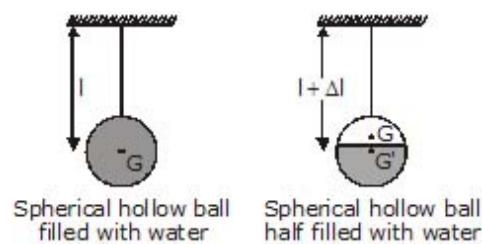
$$= \frac{5\pi}{6} - \frac{\pi}{6}$$

$$= \frac{2\pi}{3}$$

**165. Answer: 2**

**166. Answer: 1**

**Sol:**

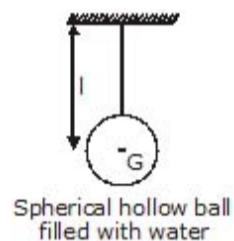


$$T = 2\pi \sqrt{\frac{l}{g}}$$

As water is coming out, CG of the system goes down, effective length increase.

$$T_1 = 2\pi \sqrt{\frac{l+\Delta l}{g}}, T_1 > T_2$$

So, time period also increases but upto half empty. As water is coming out after half empty, CG goes up.



Effective length decreases and for complete hollow sphere, CG is also at the initial position, so effective length as well as time period decreases and same as initial at last.

$$T_2 = 2\pi \sqrt{\frac{l-\Delta l}{g}}$$

and  $T_1 < T_2$

Hence, time period first increases and then decreases to the original value.

**167. Answer: 1**

**Sol:**

2.625 bar

**168. Answer: 1**

**Sol:**

At any instant the total energy in SHM is

$$\frac{1}{2}kA_0^2 = \text{constant},$$

where  $A_0$  = amplitude

$k$  = spring constant

hence total energy is independent of  $x$ .

**169. Answer: 1**

**Sol:**

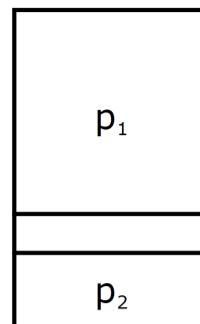
For S.H.M.  $F = -kx$ .

$\therefore$  Force = Mass  $\times$  Acceleration  $\propto -x$

$\Rightarrow F = -Ax$ ; where  $A$  and  $k$  are positive constants.

**170. Answer: 1**

**Sol:**



$$(p_2 - p_1) A = mg$$

$$\text{or } \frac{mg}{A} = \frac{RT_i}{V_i} - \frac{RT_i}{4V_i} = \frac{3RT_i}{4V_i} \quad \dots (\text{i})$$

Similarly in second case,

$$\frac{mg}{A} = \frac{RT_f}{V_2} - \frac{RT_f}{3V_2} = \frac{2RT_f}{3V_2} \quad \dots (\text{ii})$$

Further  $5V_1 = 4V_2$  Equating Eqs. (i) and (ii), we get

$$\frac{3T_i}{4V_1} = \frac{2T_f}{3V_2}$$

$$\text{or } T_f = \frac{9}{8} \times \frac{V_2}{V_1} \times T_i$$

$$= \frac{9}{8} \times \frac{5}{4} \times 320 = 450 \text{ K}$$

**171. Answer: 2**

**Sol:**

For isobaric process,  $V \propto T$

$$\frac{V_1}{V_2} = \frac{T_1}{T_2} = \frac{V}{2V} = \frac{300}{T} = T = 600 \text{ K}$$

**172. Answer: 1**

**Sol:**

In this case, frequency of oscillation is given by

$$n = \frac{1}{2\pi} \sqrt{\frac{\sqrt{g^2 + a^2}}{l}}$$

when 'a' is the acceleration of car, if 'a' increases then 'n' will also increase.

**173. Answer: 4**

**Sol:**

$$375\pi \text{ kJ}$$

**174. Answer: 2**

**Sol:**

Let  $T_1$  and  $T_2$  be the time periods of the pendulum with lengths 1.0 m and 1.21 m respectively.

$$\frac{T_2}{T_1} = \sqrt{\frac{\ell_2}{\ell_1}} = \sqrt{\frac{1.21}{1}} = 1.1 \quad \dots (1)$$

Let  $v_1$  and  $v_2$  be the vibrations made by two pendulum to swing together

$$\therefore v_1 T_1 = v_2 T_2 \quad \dots (2)$$

For the two pendulums to swing together, required condition is :

$$v_1 - v_2 = 1$$

$$\text{or } v_1 = v_2 + 1$$

$$\therefore (v_2 + 1) T_1 = v_2 T_2$$

$$\text{or } (v_2 + 1)/v_2 = T_2/T_1 = 1.1$$

$$\text{or } 1 + \frac{1}{v_2} = 1.1$$

$$\text{or } \frac{1}{v_2} = 1.1 - 1 = \frac{1}{10}$$

$$\text{or } v_2 = 10$$

**175. Answer: 2**

**Sol:**

$$H_1 = H_2$$

**177. Answer: 1**

**Sol:**

$$A \rightarrow P, B \rightarrow Q, C \rightarrow P$$

Pressure varies with height  $\Rightarrow P = \rho gh$

and is horizontal with acceleration  
 $\Rightarrow P = \rho \ell a$

so on (A)  $\rho gh$  part is zero while average  
of  $\rho gx$  is

$$\left[ \frac{0+\rho g\ell}{2} \right] [\ell^2] = \frac{\rho g}{2} (\ell^3)$$

$$= \frac{p(\ell^3)}{2}(g) = \frac{ma}{2}$$

Similarly for other part.

**179. Answer: 2**

**Sol:**

As we know that according to adiabatic expansion

$$pV^\gamma = K$$

$\gamma$  is the ratio of specific heat.

By differentiating

$$\therefore \Delta p V^\gamma + p \gamma V^{\gamma-1} \Delta V = 0$$

$$\Rightarrow \frac{\Delta p}{p} = -\gamma \frac{\Delta V}{V}$$

For monoatomic gas,

$$\gamma = \frac{5}{3}$$

$$\frac{\Delta p}{p} = \frac{5}{3} \times 24\%$$

$$\frac{\Delta p}{p} = 40\%$$

**181. Answer: 2**

**176. Answer: 1**

**Sol:**

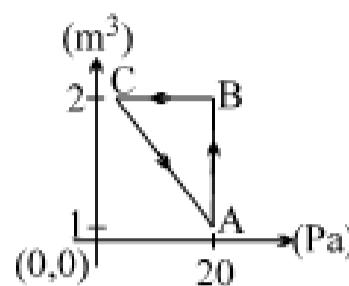
$$y = f \left( q \left( \frac{p}{q} x + t \right) \right)$$

$$V = \frac{q}{p}$$

**178. Answer: 3**

**Sol:**

The given graph is;



Since in cyclic process  $\Delta U = 0$

Hence according to 1<sup>st</sup> law of thermodynamics

$$\sum \Delta Q = \sum \Delta W$$

$$\Delta W = W_{AB} + W_{BC} + W_{CA}$$

Now,

$$P\Delta V = W_{AB} \quad (\text{isobaric})$$

$$= 20(2 - 1) = 20 \text{ J}$$

$$W_{BC} = 0 \quad (\text{isochoric}),$$

$$\text{So, } W_{CA} + 20 = 5;$$

$$W_{CA} = -15 \text{ J}$$

**180. Answer: 1**

**Sol:**

$$\begin{aligned} \Delta D &= D_i \propto \Delta T \\ &= 4.24 \times 1.7 \times 10^{-5} \times (500 - 300) \\ &= 14416 \times 10^{-6} \text{ cm} \\ &= 1.44 \times 10^{-2} \text{ cm} \end{aligned}$$

**182. Answer: 2**

**Sol:**

Young's modulus of a substance is independent of dimension s of wire.

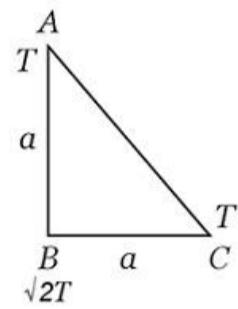
**Sol:**

$$\left( \frac{\Delta Q}{\Delta t} \right)_{BC} = \left( \frac{\Delta Q}{\Delta t} \right)_{CA}$$

$$\Rightarrow \frac{kA(\sqrt{2}T - T_C)}{a} = \frac{kA(T_C - T)}{\sqrt{2}a}$$

Solve to get

$$\frac{T_C}{T} = \frac{3}{\sqrt{2}+1}$$



**183. Answer: 1**

**Sol:**

**184. Answer: 2**

**Sol:**

$$\frac{F}{A} = y \frac{\Delta l}{Y} \quad \because y, A, L \text{ is constant}$$

$$F \propto \Delta l$$

$$\frac{1}{4} = \frac{2}{\Delta l}$$

$$\Delta l = 8 \text{ mm}$$

**185. Answer: 3**

**Sol:**

In Equilibrium condition

Tension becomes

$$T_1 \frac{L}{5} = T_2 \frac{4L}{5}$$

$$\Rightarrow \frac{T_1}{T_2} = 4 \dots\dots (1)$$

So length

$$\therefore \Delta L_1 = \Delta L_2$$

$$\frac{T_1 L}{A_1 Y} = \frac{T_2 L}{A_2 Y_2}$$

$$\frac{Y_1}{Y_2} = \left( \frac{A_2}{A_1} \right) \left( \frac{T_1}{T_2} \right)$$

$$\frac{Y_1}{Y_2} = \left( \frac{A_2}{A_1} \right) 4$$

Option 3 is correct.

**186. Answer: 2**

**Sol:**

10

**187. Answer: 3**

**Sol:**

$$T = 2\pi \sqrt{\frac{m}{k}}$$

$$\frac{5T}{3} = 2\pi \sqrt{\frac{M+m}{k}}$$

$$\frac{3}{5} = \frac{\sqrt{M}}{\sqrt{M+m}}$$

$$\frac{9}{25} = \frac{M}{M+m}$$

$$9M + 9m = 25M$$

$$9m = 16M$$

$$\frac{m}{M} = \frac{16}{9}$$

**189. Answer: 4**

**Sol:**

$$T = T_1 = T_2 < T_3$$

**188. Answer: 3**

**Sol:**

a circle

**190. Answer: 3**

**Sol:**

Let  $m_i$  is the amount of water that gets freeze out of  $M$  water at  $0^\circ C$ , due to evaporation.

$$m_i \times 80 = (M - m_i) 580 \Rightarrow \frac{m_i}{M} = \frac{580}{660} = 0.878$$

$$\text{so, max \%} = 87.8\% = 88\%$$

**191. Answer: 3**

**Sol:**

$$\Delta U_{\text{cycle}} = 0$$

$$Q_{\text{net}} = W_{\text{net}}$$

$$= -40 - 130 + 400 = W_{cb} + W_{ba} + W_{ac}$$

$$W_{ac} + W_{ba} = 230 \text{ J}$$

$$W_{ac} = 230 + 80 = 310 \text{ J}$$

$$\text{Thermal efficiency} = \frac{\text{work output}}{\text{Heat Input}}$$

$$= \frac{230}{400} \times 100 = 11.5 \times 5 = 57.5$$

**192. Answer: 1**

**Sol:**

$$U = \sum \frac{\mu RT}{\gamma-1}$$

$$= \frac{RT}{2} \left[ \frac{1}{\left(\frac{7}{5}-1\right)} \right] + RT \left[ \frac{1}{\left(\frac{7}{5}-1\right)} \right] \\ + \frac{RT}{2} \left[ \frac{1}{\left(\frac{7}{5}-1\right)} \right] + RT \left[ \frac{1}{\left(\frac{5}{3}-1\right)} \right]$$

$$= RT \left[ 5 + \frac{3}{2} \right] = \frac{13RT}{2} = 1950R$$

**193. Answer: 1**

**Sol:**

$$\frac{P_1}{P_2} = \frac{n_1 T_1}{n_2 T_2}$$

$P \propto nT$ , it implies that volume of both container is same. After mixing

$$P(2V) = (n_1 + n_2) RT = \left( \frac{P_1 V}{RT_1} + \frac{P_2 V}{RT_2} \right) RT$$

$$\frac{P}{T} = \left( \frac{P_1}{T_1} + \frac{P_2}{T_2} \right) \frac{1}{2}$$

$$\frac{P}{T} = \frac{P_1 T_2 + P_2 T_1}{2 T_1 T_2}$$

**194. Answer: 3**

**Sol:**

$$\frac{5}{2} P_0 V_0 + 2P_0 V_0 \ln 2$$

**195. Answer: 3**

**Sol:**

$$dU = \frac{1 \times 8.3 \times (102 - 27)}{0.4} = 1245 \text{ J}$$

**197. Answer: 3**

**Sol:**

$$PV = \frac{m}{M} RT, P \propto \frac{m}{M}$$

$$\frac{P_1}{P_2} = \frac{m_1}{m_2} \times \frac{M_2}{M_1}, (P_1 + P_1^1)$$

$$= 10, P_1 = 5$$

**196. Answer: 3**

**Sol:**

$$\begin{aligned} \frac{nT_2}{T_2} &= \frac{\lambda_{m_2}}{\lambda_{m_1}} \\ &= \frac{5.5 \times 10^5}{11 \times 10^5} = \frac{1}{2} \\ \text{or} \\ n &= \frac{1}{2} \end{aligned}$$

**198. Answer: 2**

**Sol:**

(P) T increasing continuously

$\therefore PV = nRT \Rightarrow P$  increases ( $A \rightarrow B$ )

&  $P = \text{const.}$  ( $B \rightarrow C$ )

(Q)  $T \downarrow$  ( $A \rightarrow B$ ) &  $T \uparrow$  ( $B \rightarrow C$ )

$PV = nRT \Rightarrow P$  decreases ( $A \rightarrow B$ )

&  $P = \text{const.}$  ( $B \rightarrow C$ )

(R)  $P \uparrow$  ( $A \rightarrow B$ ) &  $P = \text{const.}$  ( $B \rightarrow C$ )

$PV = nRT \Rightarrow T$  increases ( $A \rightarrow B$ )

&  $T$  increases ( $B \rightarrow C$ )

(S)  $P \uparrow$  ( $A \rightarrow B$ ),  $P = \text{const.}$  ( $B \rightarrow C$ )

$PV = nRT \Rightarrow T$  increases ( $A \rightarrow B$ )

&  $T$  decreases ( $B \rightarrow C$ )

**199. Answer: 1**

**Sol:**

$$L_{fe} - L_{cu} = 10 \text{ cm} \dots\dots (A)$$

$$\Delta L_{fe} - \Delta L_{Cu} = 0$$

$$\therefore L_{fe}\alpha_{fe}\Delta T = L_{cu}\alpha_{Cu}\Delta T$$

$$\frac{L_{fc}}{L_{ra}} = \frac{17}{11} \dots\dots (B)$$

Solving (A) & (B)

$$L_{fe} = 28.3 \text{ cm}, L_{cu} = 18.3 \text{ cm}$$

**200. Answer: 2**

**Sol:**

As we know that

Breaking stress ( $S$ ) = pressure =  $\rho gh$

$$S = h(\rho_{body} - \rho_{liquid}) 9.8$$

$$9.8 \times 10^8 = h(6000 - 1000) 9.8$$

$$h = 20 \times 10^3 \text{ m}$$

Therefore, the correct answer is (B)