26/03/2026

Code-A

Aakash
Medical | IIT-JEE | Foundations

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Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

MM : 720 Final Test Series(P1)_NEET2026_Test-04A **Time : 180 Min.**

PHYSICS

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CHEMISTRY

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BOTANY

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ZOOLOGY

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175. (1)
176. (2)
177. (3)
178. (2)
179. (1)

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157. (1)

158. (4)

180. (2)

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Hints and Solutions

PHYSICS

(1) **Answer :** (2)
Solution:
Path difference between particles 1 and 2 will be $\Delta x = \frac{\lambda}{8} + \frac{\lambda}{8} = \frac{\lambda}{4}$
Phase difference, $\Delta\phi = k\Delta x = \frac{2\pi}{\lambda} \cdot \frac{\lambda}{4} = \frac{\pi}{2}$

(2) **Answer :** (4)
Solution:
Solids have higher density (ρ) and much higher value of bulk modulus (*B*) than gases,
∴ Velocity of sound, $V_{solid} > V_{gas}$

(3) **Answer :** (3)
Solution:
Amplitude *A* = 2 cm
Angular frequency ω = 2π rad/s
∴ Maximum speed $V_{max} = \omega A = 4\pi$ cm/s

(4) **Answer :** (2)
Solution:
Let amplitude of each of these springs (*k*, 2*k*, 3*k*) = x_1, x_2, x_3
At point *P*, $kx_1 = 2kx_2 \Rightarrow \frac{x_1}{x_2} = \frac{2}{1} \Rightarrow x_1 = 2x_2$
∴ Ratio of amplitudes = $\frac{A_P}{A_Q} = \frac{x_1}{x_1 + x_2} = \frac{2x_2}{3x_2} = \frac{2}{3}$

(5) **Answer :** (2)
Solution:
• sin(ω*t*) + cos(ω*t*) + cos(2ω*t*), is not simple harmonic but has time period $= \text{LCM}\left(\frac{2\pi}{\omega}, \frac{2\pi}{\omega}, \frac{\pi}{\omega}\right) = \frac{2\pi}{\omega}$
• $\sin\left(\frac{\pi}{4} - \omega t\right)$ is simple harmonic with time period = $\frac{2\pi}{\omega}$
• $\sin^2(\omega t)$ is not simple harmonic and has time period = $\frac{\pi}{\omega}$

(6) **Answer :** (3)
Solution:
Let $y = A\sin(\omega t + \varphi)$
At $t = 0$, $y = -4\sin30° = A\sin\varphi$
⇒ $A = -4$ m and $\varphi = 30°$
Velocity $v = \frac{dy}{dt} = A\omega\cos(\omega t + \varphi)$
At $t = 0$, $v = A\omega\cos\varphi = -4 \times \frac{2\pi}{2} \times \cos30°$ = –ve is correct
∴ *y*-projection is given by $y = -4\sin\left(\pi t + \frac{\pi}{6}\right)$ m

(7) **Answer :** (3)
Solution:
Heat supplied at constant pressure, $Q_1 = nC_p(400)$
Heat supplied at constant volume, $Q_2 = nC_v\Delta T$
$Q_1 = Q_2 \Rightarrow \Delta T = \frac{C_p}{C_v}400 = 1.33 \times 400 = 532$ K

(8) **Answer :** (4)
Solution:
Rotational degree of freedom of O_2 gas = $f = 2$
Average rotational kinetic energy of *n* moles of O_2 gas = $K = \left(\frac{f}{2}K_BT\right)nN_A = \frac{f}{2}nRT$
$\therefore K = \frac{4RT}{2} = 2RT$

(9) **Answer :** (3)

Solution:
In process AB : $P \propto T$ and P increases $\Rightarrow T_B > T_A$
In process CA : $V \propto T$ and V decreases $\Rightarrow T_C > T_A$
In process BC : T_{max} is attained somewhere in the middle
$T_A + T_B + T_C \neq 0$

(10) Answer : (1)
Solution:
All natural thermodynamic processes are irreversible, meaning they spontaneously occur in one direction only.
All reversible thermodynamic processes are quasi-static meaning they must occur infinitely slowly.

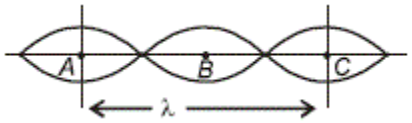
(11) Answer : (4)
Solution:
In an adiabatic process, slope of P-V curve $= \frac{dP}{dV} = -\gamma\frac{P}{V}$
Larger γ results in a steeper (more negative) slope
$\gamma_{\text{monoatomic}} > \gamma_{\text{diatomic}} \left(\because \frac{5}{3} > \frac{7}{5}\right)$
Plot B is steeper $\Rightarrow$ B is monoatomic (He) and A is diatomic (O_2)

(12) Answer : (4)
Solution:
Total energy of SHM, $E = \frac{1}{2} m\omega^2A^2 = \frac{1}{2}kA^2$
$\frac{E'}{E} = \left(\frac{2A}{A}\right)^2 = 4 \Rightarrow E' = 4E$

(13) Answer : (2)
Solution:
$x = A\cos(\omega t)$
$\frac{A}{2} = A\cos(\omega t) \Rightarrow \cos(\omega t) = \frac{1}{2} = \cos\left(\frac{\pi}{3}\right)$
$\therefore \frac{2\pi}{T}t = \frac{\pi}{3} \Rightarrow t = \frac{T}{6} = \frac{1}{6}$ second

(14) Answer : (2)
Solution:
According to Charle's law,
$V \propto T$ ($\because P$ = constant)
$\Rightarrow \frac{V}{T}$ = constant

(15) Answer : (4)
Hint:
Minimum distance between two consecutive antinode where particles are in same phase is λ
Solution:



Particles at point A and B have opposite phase while particles at A and C have same phase
Now,
$k = \frac{\pi}{2}$
$\frac{2\pi}{\lambda} = \frac{\pi}{2}$
$\Rightarrow \boxed{\lambda = 4\,\text{m}}$

(16) Answer : (2)
Solution:
Equation of velocity is given by $v = \omega A\cos(\omega t)$
Displacement $x = A\sin(\omega t)$
(A-P, R) At position 1, $v = 0$
$\Rightarrow$ KE is minimum
(B-R) at position 2,
$\frac{3\pi}{2} < \omega t < 2\pi$
$\therefore x$ is negative
(C-Q) At position 3, v is maximum

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⇒ PE is minimum

(17) **Answer :** (3)
Solution:
Non-uniform circular motion is non-periodic and also not oscillatory motion.

(18) **Answer :** (3)
Solution:
B-A and *D-C* are isothermal processes.
C-B and *A-D* are isochoric processes.
Total work done = $W = W_{BA} + W_{AD} + W_{DC} + W_{CB}$

$= nRT_0 \ln\left(\frac{V_0}{2V_0}\right) + 0 + nR(3T_0)\ln\left(\frac{2V_0}{V_0}\right) + 0$

$= -2RT_0\ln 2 + 6RT_0\ln 2 = 4RT_0\ln 2$

In process *A-D*, $Q_1 = \Delta U = nC_V\Delta T = 2 \times \frac{5R}{2} \times 2T_0 = 10RT_0$

In process *D-C*, $Q_2 = W_{DC} = 6RT_0\ln 2$

$\therefore$ Efficiency = $\frac{\text{Total work done}}{\text{Total heat input}} = \frac{W}{Q_1 + Q_2}$

$\Rightarrow \eta = \frac{4RT_0 \ln 2}{10RT_0 + 6RT_0 \ln 2} = \frac{4\ln 2}{10 + 6\ln 2} = \frac{2.8}{14.2} = \frac{14}{71}$

(19) **Answer :** (1)
Solution:
For small damping, the damped oscillations are approximately periodic. They repeat their pattern regularly but with a gradually decreasing amplitude due to energy loss from resistive forces like air resistance. This lost energy is dissipated as heat.

(20) **Answer :** (4)
Solution:
Frequency of third overtone of a
• Open organ pipe, $f_o = \frac{4v}{2l_0}$
• Closed organ pipe, $f_c = \frac{7v}{4l_c}$
$f_o = f_c \Rightarrow \frac{4v}{2l_o} = \frac{7v}{4l_c} \Rightarrow \frac{l_o}{l_c} = \frac{16}{14} = \frac{8}{7}$

(21) **Answer :** (4)
Solution:
In a standing wave, two successive particles have different amplitudes and all the particles cross their mean position at the same instant. Energy doesn't travel through the medium across the nodes.

(22) **Answer :** (3)
Solution:
Wave speed $v = \sqrt{\frac{T}{\mu}} \Rightarrow \mu = \frac{T}{v^2}$
$\mu = \frac{M}{L} = \frac{\rho AL}{L} \Rightarrow \rho A = \frac{T}{v^2}$
$\therefore \rho = \frac{T}{Av^2} = \frac{3}{\frac{2}{27} \times 10^{-4} \times 900} = \frac{9}{2} \times 10^2$
$= 450 \text{ kg/m}^3$

(23) **Answer :** (2)
Solution:
At equilibrium, extension in each spring = x_0
$T' = kx_0$
$4T' = mg \Rightarrow 4kx_0 = mg$
If block further comes down by x and each spring further extends by x_1
Work done by tension = 0
$Tx_1 + Tx_1 - 4Tx = 0 \Rightarrow x_1 = 2x$
For the block,
$mg - 4T = ma$
$\Rightarrow mg - 4k(x_0 + x_1) = ma$
$\Rightarrow mg - 4kx_0 - 4k(2x) = ma$
$\Rightarrow \frac{-8k}{m}x = a = -\omega^2 x$

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$\Rightarrow \omega^2 = \frac{8k}{m}$

$\therefore$ Time period, $T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{8k}} = \pi\sqrt{\frac{m}{2k}}$

(24) **Answer :** (4)
Solution:
Heat and work are path functions. Internal energy is a state function.

(25) **Answer :** (1)
Solution:
In an isobaric process, pressure of gas remains constant.

(26) **Answer :** (4)
Solution:
In closed organ pipe, if $y_{\text{incident}} = a\sin(\omega t - kx)$
then $y_{\text{reflected}} = a\sin(\omega t + kx + \pi) = -a\sin(\omega t + kx)$
Superposition of these two waves give the required stationary wave.

(27) **Answer :** (3)
Hint:
Use Dalton's law of partial pressure.
Solution:
$n_1 = \frac{PV}{RT}$
$n_2 = \frac{PV}{RT}$
$n_3 = \frac{PV}{RT}$
$N = n_1 + n_2 + n_3$
$\frac{P_1V}{RT} = \frac{PV}{RT} + \frac{PV}{RT} + \frac{PV}{RT}$
$P_1 = 3P$

(28) **Answer :** (4)
Solution:
In an adiabatic process, net heat exchanged (Q) = 0

(29) **Answer :** (3)
Hint:
$\gamma = 1 + \frac{2}{f}$
Solution:
$\gamma = 1 + \frac{2}{f}$
$= 1 + \frac{2}{6} = \frac{4}{3}$

(30) **Answer :** (2)
Solution:
The force of interaction between molecules is assumed to be negligible according to kinetic theory of gases.

(31) **Answer :** (1)
Solution:
Since the temperature T is kept constant, the r.m.s. speed is independent of pressure. Therefore, even if the pressure is doubled, the r.m.s. speed remains the same.

(32) **Answer :** (1)
Solution:
$\Delta U = nC_v\Delta T = 0$ (as $\Delta T = 0$)

(33) **Answer :** (2)
Solution:
The kinetic energy of the vessel will be converted in internal energy and temperature would increase.

(34) **Answer :** (3)
Solution:
Molar specific heat capacity of water = $9R$
$= 9 \times 8.314 \simeq 75$ J mol^{-1} K^{-1}

(35) **Answer :** (1)

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Solution:

Pressure = $\frac{1}{3}\rho v_{rms}^2$

$= \frac{1}{3} \times 6 \times 10^{-2} \times 500 \times 500$

= 5 × 10^3 Pa

(36) **Answer :** (3)

Solution:

Slope of graph = $\frac{dP}{dV} = -n\frac{P}{V} = \tan 150^\circ = -\tan 30^\circ$

$\Rightarrow n\frac{P}{V} = \frac{1}{\sqrt{3}} \Rightarrow n = \frac{V}{P\sqrt{3}} = \frac{600}{100 \times 3} = 2$

Molar heat capacity,

$C = C_V + \frac{R}{1-n} = \frac{3R}{2} - R = \frac{R}{2}$

(37) **Answer :** (4)

Solution:

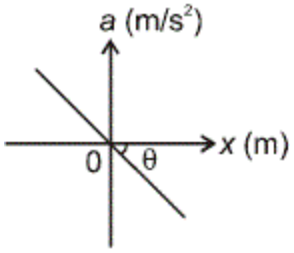
At the mean position, the acceleration of the particle executing SHM is zero and velocity is maximum.

(38) **Answer :** (2)

Hint:

$f = \frac{\omega}{2\pi}$

Solution:



$a = -\omega^2 x$

Slope of straight line

$m = \tan(180° - \theta)$

$m = -\tan\theta$

$\Rightarrow -\omega^2 = -8$

$\Rightarrow \omega = 2\sqrt{2}$ rad/s

$\Rightarrow f = \frac{\sqrt{2}}{\pi}$ Hz

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(39) **Answer :** (4)

Solution:

Beats are formed due to superposition of two waves of slightly different frequency.

(40) **Answer :** (4)

Solution:

Mean free path of the gas molecule $(l) = \frac{1}{\sqrt{2}n\pi d^2}$

Using $n = \frac{N}{V} = \frac{PN_A}{RT} = \frac{P}{K_B T}$,

We get $l = \frac{K_B T}{\sqrt{2}P\pi d^2}$

(41) **Answer :** (1)

Hint:

In string, fundamental frequency $f_0 = \frac{v}{2L}$ (for same *T* and μ)

Solution:

$L = L_1 + L_2 + L_3$

$\frac{v}{2f_0} = \frac{v}{2f_1} + \frac{v}{2f_2} + \frac{v}{2f_3}$

$\frac{1}{f_0} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$

(42) **Answer :** (4)

Solution:

Intensive properties do not depend on the quantity of matter e.g. molar heat capacity.

(43) **Answer :** (2)
Solution:
During reflection from a free end, no phase change occurs and only the direction of propagation of wave gets reversed.

(44) **Answer :** (4)
Solution:
Periodic motion is the motion which repeats itself after a regular interval of time.
∴ Motions in (1), (2), (3) are all periodic with time period = T

(45) **Answer :** (3)
Solution:
f_m → Degree of freedom of mixture.

$f_m = \frac{n_1 f_1 + n_2 f_2}{n_1 + n_2} = \frac{2\times5+2\times3}{2+2} = 4$

For the mixture, adiabatic constant $\gamma_m = 1 + \frac{2}{f_m} = 1 + \frac{2}{4} = \frac{3}{2}$

For adiabatic process
PV^{γ_m} = constant
⇓
$TV^{\gamma_m - 1}$ = constant

$T_0 V_0^{\frac{3}{2}-1} = T\left[\frac{V_0}{4}\right]^{\frac{3}{2}-1}$

$T = T_0[4]^{\frac{3}{2}-1}$
$T = 2T_0$

∴ Total energy = $\frac{n_1 f_1 RT}{2} + \frac{n_2 f_2 RT}{2}$

Total energy = $2\times\frac{5RT}{2} + 2\times\frac{3RT}{2}$
$E = 8RT = 8R[2T_0] = 16RT_0$

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CHEMISTRY

(46) **Answer :** (2)
Solution:

Slope $= -\frac{E_a}{2.303\,R} = -10$

$E_a = 23.03\ R$

(47) **Answer :** (1)
Solution:

$\frac{k}{A} = e^{-E_a/RT} = e^{-\frac{103.35\times1000}{8.314\times300}} = 1\times10^{-18}$

(48) **Answer :** (3)
Solution:
$t_{87.5\%} = 3 \times t_{1/2}$
$= 3 \times 40 = 120$ s

(49) **Answer :** (3)
Solution:
Given for the first order reaction, $t_{40\%} = 50$ sec.

Now $t_{64\%}$ is 2nd $t_{40\%}$ and for a first order reaction $t_{x\%}$ remains constant.
∴ $t_{64\%} = 2 \times t_{40\%} = 2 \times 50 = 100$ sec.

(50) **Answer :** (3)
Solution:

$Rate = Z_{AB} e^{-Ea/RT}$

Z_{AB} = Collision frequency

(51) **Answer :** (3)
Solution:

For second order

$r = k[A]^2$

$r' = k[2A]^2 = 4k[A]^2 = 4r$

(52) Answer : (1)

Solution:

Slowest step is rate determining step

$r = k[X][Y_2]$

Now

$$k_c = \frac{[X]^2}{[X_2]}$$

$$[X] = \sqrt{k_c(X_2)}$$

$$r = k\sqrt{k_c}(X_2)^{\frac{1}{2}}\left(Y_2\right)$$

$$r = k'(X_2)^{\frac{1}{2}}\left(Y_2\right)$$

(53) Answer : (2)

Hint:

$\frac{\Delta P}{P_s} = \frac{\eta_B}{n_A}$

Solution:

Lowering in vapour pressure

$\Delta P = 740 - 720 = 20$ mm Hg

$$\frac{\Delta P}{P_s} = \frac{\eta_B}{n_A} = \frac{\omega_B}{m_B} \cdot \frac{18}{100}$$

$$\frac{20}{720} = \frac{5}{m_B} \times \frac{18}{100} \Rightarrow m_B = 32.4$$

(54) Answer : (2)

Hint:

Complex $[CrCl_3 \cdot xNH_3]$ is an octahedral complex.

Solution:

$\Delta T_{b(complex)}$

$= \Delta T_{b(glucose)}$

$iK_bm = 3 \times i \times K_b \times m$

$1 \times 1 = 3 \times 1 \times 1$

$i = 3$ [$\because$ product produces 3 ions]

$\therefore x = 5$

Complex $= [CrCl(NH_3)_5]Cl_2$

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(55) Answer : (2)

Solution:

Rate = k (for zero order).

(56) Answer : (3)

Solution:

Ions at equilibrium $\underset{1-\alpha}{Ca(OH)_2} \rightleftharpoons \underset{\alpha}{Ca^{2+}} + 2\underset{2\alpha}{OH^-}$

$i = 1 + 2\alpha = 1 + 2 \times 0.8 = 2.6$

$\Delta T_f = iK_fm = 2.6 \times 1.86 \times \frac{3.7 \times 1000}{74 \times 100} = 2.418$

$T_{f(solution)} = 0 - 2.418$

$= -2.418$ °C

(57) Answer : (2)

Solution:

$\Delta_{mix}S$ for ideal solution is not zero.

(58) Answer : (1)

Solution:

A mixture showing negative deviation from Raoult's Law, interaction between two different components should be stronger than that in their pure forms and $\Delta V_{mix} < 0$, $\Delta S_{mix} > 0$.

(59) Answer : (3)

Hint:

$\Delta T_b = K_b m$

Solution:

$[\Delta T_b = T_b - T_b^0]$

= (374 – 373) K = 1 K

$1 = \frac{0.52 \times W \times 1000}{60 \times 100} \Rightarrow W_B = 11.54$ g

(60) Answer : (4)

Hint:

$\Delta T_b = K_b m$ and $\Delta T_f = K_f m$

Solution:

$$\frac{\Delta T_b}{\Delta T_f} = \frac{K_b}{K_f}$$

$$\frac{1.2}{\Delta T_f} = \frac{0.512}{1.86} \Rightarrow \Delta T_f = 4.36$$

Freezing point of solution = (0 – 4.36)°C = –4.36°C

(61) Answer : (4)

Hint:

$$-\frac{1}{2}\frac{d[HI]}{dt} = \frac{d[H_2]}{dt}$$

Solution:

$$-\frac{d[HI]}{dt} = \frac{2d[H_2]}{dt} = 2 \times 8 \times 10^{-4}$$

= 16×10^{-4} mol L^{-1} s^{-1}

(62) Answer : (3)

Hint:

• $P = K_H x$

• Higher the value of Henry's Law constant, lower will be the solubility of the gas

Solution:

• Correct order of solubility of gases in water is C > D > B > A

(63) Answer : (2)

Hint:

According to first law of Faraday; $\omega = ZIt$

Solution:

$2Cl^{\ominus} \rightarrow Cl_{2(g)} + 2e^-$

n factor for Cl_2 = 2

$$n = \frac{It}{nF}$$

$$\frac{22.4}{22.4} = \frac{I \times 96500}{2 \times 96500}$$

I = 2 A

(64) Answer : (2)

Hint:

$$\underset{1 \text{ mole}}{Al^{3+}} + 3 \text{ mole of electrons} \rightarrow \underset{1 \text{ mole}}{Al}$$

$$\underset{3\,F}{}$$

Solution:

Products of electrolysis depend on both the nature of electrolyte and nature of electrodes used.

(65) Answer : (4)

Hint:

Cell reaction in standard state will be spontaneous if E°_{cell} is positive.

• $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$

Solution:

• $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow Cr^{3+} + 7H_2O$ ...(i)

$E^\circ_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33V$

• $NO + 2H_2O \rightarrow NO_3^- + 4H^+ + 3e^-$ ...(ii)

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$E^{\circ}_{NO_3^- / NO} = 0.97$

Using (i) + 2 ×(ii), net cell reaction is

$Cr_2O_7^{2-} + 2NO + 6H^+ \rightarrow Cr^{3+} + 2NO_3^- + 3H_2O$

$E^{\circ}_{cell} = E^{\circ}_{cathode} - E^{\circ}_{anode}$

$= E^{\circ}_{Cr_2O_7^{2-} / Cr^{3+}} - E^{\circ}_{NO_3^- / NO}$

= 1.33 – 0.97

= 0.36 V

(66) **Answer :** (3)

Hint:

Having same charge, the smaller cations are more solvated leading to decreased ionic mobility and decreased molar conductivity.

Solution:

OH^- has exceptionally high value of molar conductivity in water at 298 K.

Mg^{2+} is smaller in size than Ca^{2+} hence Mg^{2+} is more solvated and its molar conductivity is lesser than Ca^{2+} ions in water at 298 K.

(67) **Answer :** (2)

Hint:

$2\Lambda^{\circ}_m(NH_4OH) = 2\Lambda^{\circ}_m(NH_4Cl) + \Lambda^{\circ}_m\{Ba(OH)_2\} - \Lambda^{\circ}_m(BaCl_2)$

Solution:

$2\Lambda^{\circ}_m(NH_4OH) = 2y + x - z$

$\Lambda^{\circ}_m(NH_4OH) = y + \frac{x}{2} - \frac{z}{2}\ (S\ cm^2\ mol^{-1})$

(68) **Answer :** (1)

Hint:

Degree of dissociation $(\alpha) = \frac{\Lambda_m}{\Lambda^{\circ}_m}$

Solution:

$\alpha = \frac{12}{400} = 0.03$

For weak acid, $K = C\alpha^2$

$K = 0.05 \times (0.03)^2$

$K = 4.5 \times 10^{-5}$

(69) **Answer :** (3)

Solution:

$\left(t_{1/2}\right)_0 = \frac{A}{2K_0}$

$10 = \frac{2.079}{2K_0}$

$K_0 = \frac{2.079}{40}$

$\left(t_{1/2}\right)_1 = \frac{0.693}{K_1}$

$K_1 = \frac{0.693}{20}$

$\frac{K_1}{K_0} = \frac{0.693 \times 20}{20 \times 2.079}$

$= \frac{1}{3}$

(70) **Answer :** (4)

Solution:

$K = \frac{2.303}{(t_2 - t_1)} \log\left(\frac{r_1}{r_2}\right)$

$K = \frac{2.303}{90 - 30} \log\left(\frac{0.06}{0.04}\right)$

$K = \frac{2.303 \times 0.17}{60}$

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$t_{1/2} = \frac{0.693}{K}$

$= \frac{0.693 \times 60}{2.303 \times 0.17}$

$= 106 \text{ min}$

(71) Answer : (3)

Solution:

• aq HCl show negative deviation from ideal behaviour hence B.P. of solution will be higher.

• Reverse osmosis is nonspontaneous.

• Addition of HgI_2 in KI solution results into decrease of B.P. due to formation of $K_2[HgI_4]$

(72) Answer : (1)

Hint:

$E°_{Cell}$ is intensive property while $\Delta G°$ is extensive property.

Solution:

	$E°_{cell}$	$\Delta G°$	
$Cu^{2+} + 2e^- \rightarrow Cu$	x V	–2Fx	...(i)
$Cu^{2+} + e^- \rightarrow Cu^+$	y V	–Fy	...(ii)

(i) – (ii) will give

$Cu^+ + e^- \rightarrow Cu$; z V or (Fy – 2Fx) V

–zF = Fy – 2Fx

z = 2x – y

(73) Answer : (2)

Solution:

On passing same amount of charge through different electrodes, equal number of gram equivalent gets deposited.

$(n_{eq})_{Ag} = (n_{eq})_{Al}$

$= \frac{18 \times 10^3 \times 3}{27}$

$W_{Ag} = (n_{eq} \times E)_{Ag}$

$= \frac{18 \times 10^3 \times 3}{27} \times \frac{108}{1}$

$= 216 \times 10^3$ g

= 216 kg

(74) Answer : (4)

Solution:

• Solutions with same number of relative solute particles has same colligative properties.

• K_f and K_b depends on solvent only

(75) Answer : (3)

Solution:

Unit of rate of reaction is Mol L^{-1} s^{-1}

(76) Answer : (4)

Solution:

More reactive metal can be used as sacrificial anode.

Mg is more reactive than iron.

(77) Answer : (4)

Solution:

For dissociation of salt A_xB_y

$A_xB_y \rightarrow xA^{y+} + yB^{x-}$

$i = 1 + (n-1)\alpha$

$n = x + y$

(a) $K_2SO_4 \rightarrow 2K^+ + SO_4^{2-}$

$i = 1 + (2) \times 0.7 = 2.4$

(b) $Ca_3(PO_4)_2 \rightarrow Ca^{2+} + PO_4^{3-}$

$i = 1 + (4) \times 0.6 = 3.4$

(c) $Al_2(SO_4)_3 \rightarrow 2Al^{3+} + 3SO_4^{2-}$

$i = 1 + (4) \times 0.75 = 4$

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(d) $\mathrm{HCOOH} \rightarrow \mathrm{HCOO}^{-} + \mathrm{H}^{+}$
$\mathrm{i} = 1 + 2 = 1.8$

(78) Answer : (3)
Solution:
$r = k[A]^2[B]^{-1}$
On making conc. twice
$r' = k[2A]^2[2B]^{-1}$
$r' = 4 \times \frac{1}{2} k[2A]^2[2B]^{-1}$
$r' = 2r$

(79) Answer : (2)
Solution:
$r = k[X]^a[Y]^b$
$1.2 \times 10^{-3} = k[0.1]^a[0.2]^b$
$3 \times 10^{-2} = k[0.1]^a[0.1]^b$
$2.4 \times 10^{-3} = k[0.2]^a[0.2]^b$
(I) ÷(II)
$2^b = 4$
b = 2
(I) ÷(III)
$\left(\frac{1}{2}\right)^a = \frac{1}{2}$
a = 1
$r = k[X][Y]^2$

(80) Answer : (1)
Solution:
It is a zero order reaction
$t_{100\%} = \frac{a}{k}$
$= \frac{1}{2.5 \times 10^{-2}}$
= 40 s

(81) Answer : (2)
Solution:
- Hydrolysis of ester in acidic medium is a pseudo first order reaction.
- Decomposition of NH_3 on Pt(s) surface at high pressure is a zero order reaction.

(82) Answer : (2)
Solution:
Rate constant increases with increase in temperature for both exothermic and endothermic reaction.

(83) Answer : (2)
Solution:
Λ_m° of weak electrolyte is obtained by using kohlrausch law of independent migration of ions.

(84) Answer : (2)
Hint:
Cathode : grid of Pb packed with PbO_2
Anode : lead plates

(85) Answer : (3)
Solution:
$E_{cell} = E_{cell}^\circ - \frac{0.0591}{n} \log \frac{[Zn^{2+}]}{[H^+]^2}$
$= 0.76 - \frac{0.0591}{2} \log \frac{10^{-2}}{10^{-8}}$
= 076 – 0.1773
= 0.5827 V

(86) Answer : (2)
Solution:
Ag is less reactive than Cu.

(87) **Answer :** (4)
Solution:
Given cell is a concentration cell for which $E^{\circ}_{cell} = 0$
So, $K_{eq} = 1$

(88) **Answer :** (4)
Solution:
For isotonic solution
$\pi_1 = \pi_2$
$i_1C_1 = i_2C_2$
for $CaCl_2$ $\Rightarrow i \times C = 2 \times 0.1 = 0.2$
for 0.2 M $C_{12}H_{22}O_{11}$ $\Rightarrow i \times C = 1 \times 0.1 = 0.2$

(89) **Answer :** (3)
Solution:
For spontaneous cell
$\Delta G < 0$, $E_{cell} > 0$

(90) **Answer :** (4)
Solution:
Number of mole = $m \times W_{solvent}$
$0.5 = 2 \times W$
$W = 0.25$ kg = 250 g

BOTANY

(91) **Answer :** (2)
Solution:
Kurosawa, in 1926, reported the appearance of symptoms of the 'Bakanae' (foolish seedling) disease in rice seedlings, when they were treated with sterile filtrates of the fungus. This led to the discovery of gibberellin.

(92) **Answer :** (2)
Solution:
Herbicidal action – 2, 4-D
Elongation of fruits like apple – GA_3
Stimulation of closure of stomata – Abscisic acid
Ripening of fruit – Ethylene

(93) **Answer :** (2)
Hint:
Redifferentiated cells lose their ability to divide.
Solution:
Secondary xylem and cork are the examples of redifferentiated tissues.

(94) **Answer :** (2)
Solution:
Growth in pollen tubes is primarily measured by the increase in length. This is because, pollen tubes grow by elongation, which is a key indicator of their growth.

(95) **Answer :** (2)
Solution:
Auxin and cytokinin are antagonistic to each other, as auxin promotes apical dominance, whereas, cytokinins help to overcome the apical dominance.

(96) **Answer :** (3)
Solution:
Higher internal auxin concentration induces parthenocarpy in banana.

(97) **Answer :** (2)
Solution:
Auxins are derived from indole compounds.

(98) **Answer :** (2)
Hint:

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In the exponential growth equation, $W_1 = W_0 e^{rt}$, 'r' is referred to as efficiency index.

Solution:

'r' is the relative growth rate and is also the measure of the ability of the plant to produce new plant material, referred to as efficiency index.

(99) Answer : (3)

Hint:

It is used to initiate flowering and for synchronizing fruit-set in pineapple.

Solution:

Ethylene promotes rapid internode petiole elongation in deep water rice plants.

(100) Answer : (3)

Hint:

Apomixis is the formation of seeds without fertilization.

Solution:

Apomixis is a type of asexual reproduction that mimics sexual reproduction. In both cases, seed formation occurs.

(101) Answer : (3)

Solution:

The tapetum cells generally have more than one nucleus and they perform the function of nourishment of pollen grains.

(102) Answer : (2)

Solution:

Double fertilization occurs in angiosperms only.

(103) Answer : (1)

Solution:

Coconut water from tender coconut is free-nuclear endosperm.

(104) Answer : (2)

Hint:

In an ovule, chalaza is opposite to micropylar end. Micropyle is the apical part of ovule.

Solution:

Chalaza is the basal part of ovule.

(105) Answer : (3)

Solution:

The female reproductive organ of *Papaver* and *Michelia* have multicarpellary, syncarpous pistil and multicarpellary, apocarpous gynoecium respectively.

(106) Answer : (1)

Solution:

If the female flowers are bisexual, then removal of anthers from the flower bud before the anther dehisces is necessary. This step is referred to as emasculation.

(107) Answer : (4)

Solution:

In angiosperms, microsporogenesis is referred to as formation of microspsores by meiotic division.

(108) Answer : (3)

Solution:

A typical anther is tetragonal.

(109) Answer : (4)

Solution:

Synergids have finger like projection known as filiform apparatus.

(110) Answer : (2)

Solution:

Auxin prevent fruit and leaf drop at early stages of plant. It was first isolated from human urine.

(111) Answer : (1)

Solution:

Turgidity of plant cells helps in extension growth. Thus, plant growth and further development is intimately linked to the water status of plant.

(112) Answer : (2)

Hint:

Occurrence of more than one embryo in a seed is referred to as polyembryony.

Solution:

In a polyembryonic seed, the embryo may be zygotic, nucellar and integumentary. Only the zygotic embryo is the result of syngamy. Although, all the embryos are diploid.

(113) Answer : (3)
Solution:
The cells proximal to the meristematic zone represent the phase of elongation. Increased vacuolation, cell enlargement and new cell wall deposition are the characteristics of the cells in this phase.

(114) Answer : (3)
Solution:
Cytokinin promotes shoot formation in callus and its lesser concentration in comparison to auxin, will result in the formation of root from callus.

(115) Answer : (2)
Solution:
In the root apical meristem, the fate of cells is strongly influenced by their position.
Cells displaced towards root tip, differentiate into root cap cells.
Cells pushed towards the periphery, differentiate into epidermal cells.
Differentiation of a tissue is highly dependent on the location of the cells within.

(116) Answer : (4)
Solution:
When the apical bud of plant is removed, the lateral bud will start growing, and hence suppress apical dominance.

(117) Answer : (4)
Solution:
After four generations of mitosis, the number of meristematic cells will be = 2^4 = 16
Arithmetic phase
Duration – 5 cycle
In arithmetic growth, only one meristematic cell is added per cycle.
Meristematic cells at end = 16
Total cells added during arithmetic phase = 16 × 5 = 80

(118) Answer : (3)
Solution:
Plant growth regulators are small, simple organic substances of diverse or different chemical composition, which are required in low concentration, like the hormones in animals.

(119) Answer : (2)
Solution:
The given plant shows different leaf forms in different environments.
Such variation is a classic example of phenotypic plasticity.

(120) Answer : (4)
Solution:
Spraying of gibberellic acid on a cabbage plant will promote bolting (internode elongation just prior to flowering).

(121) Answer : (3)
Solution:
Growth is an irreversible permanent increase in size of an organ or its parts or even of an individual cell.

(122) Answer : (1)
Solution:
RGR of leaf X
Initial area = 10 cm^2
Increase 15 – 10 = 5 cm^2
$RGR_X = \frac{5}{10} \times 100 = 50\%$
RGR of leaf Y
Initial area = 25 cm^2
Increase = 5 cm^2
$RGR_Y = \frac{5}{25} \times 100 = 20\%$
$\frac{RGR_X}{RGR_Y} = \frac{0.5}{0.2} = 2.5$
Leaf X shows a relative growth rate 2.5 times that of leaf Y.

(123) Answer : (4)
Solution:

Auxin was first isolated from human urine. It is a plant growth promoter. Some of its synthetic forms are used as weedicides. Auxin inhibits abscission of young leaves, fruits and flowers. At very high concentration, it inhibits flowering in lettuce.

(124) Answer : (2)
Solution:
Antipodal cells (n) = 8
Cells of the aleurone layer (3 n) = 3 × 8 = 24
Scutellum (2 n) = 2 × 8 = 16

(125) Answer : (4)
Solution:
Only R3 enhances genetic variation. Only one route (R3) works under self- incompatibility. Isolation increases the chances of recessive abnormalities without affecting the survival of parents.

(126) Answer : (2)
Solution:
White coloured flower producing plants can also be pollinated by the biotic agents such as bees or wasps. Synergids are two distinct specialized cells located next to the egg cell at micropylar end. Optimal and rapid pollen germination can be studied by dusting the pollens on a glass slide containing a drop of 10 % sugar solution with boric acid.
The nucleus of the functional megaspore undergoes three sequential mitotic division, after which, cell walls are laid down leading to organisation of embryo sac.

(127) Answer : (4)
Solution:
Spindle shape of generative cell is a consequence of unequal division.

(128) Answer : (3)
Solution:
One of the megaspores is functional while the other three degenerate.
The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2- nucleate embryo sac. Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later, the 8-nucleate stage of the embryo sac.

(129) Answer : (2)
Solution:
In the male gametophyte of the flowering plants, two cells are present: vegetative cell and generative cell. Vegetative cell is the larger cell. It has irregularly shaped nucleus and contains abundant food reserve.

(130) Answer : (3)
Solution:
Xenogamy is the transfer of pollen grains from a flower of one plant to the stigma of the another plant belonging to the same species and it brings genetic recombination.

(131) Answer : (3)
Solution:
Nucellus is persistent in the seeds of beet and black pepper.

(132) Answer : (4)
Solution:
Colorful petals or sepals are necessary for biotic pollinators.

(133) Answer : (2)
Solution:
Apomixis actually reduces the cost of hybrid seed production.
Apomixis maintains genetic uniformity because it lacks meiosis and fertilisation. The absence of reduced gametes and the absence of fertilization will preserve the maternal genotype in the offspring.

(134) Answer : (3)
Solution:
Plants such as *Amorphophallus* and *Yucca* are mainly pollinated by insects.

(135) Answer : (2)
Solution:
Protandry is the condition where the anther matures before the stigma and hence it will prevent self-pollination.
Dioecy promotes and ensure Xenogamy (cross-pollination).

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ZOOLOGY

(136) Answer : (2)

Hint:

Ca^{+2} initiates muscle contraction.

Solution:

A nerve impulse $\rightarrow$Release of Ca^{+2} from sarcoplasmic reticulum $\rightarrow$Cross-bridge formation $\rightarrow$ Power stroke $\rightarrow$ Muscle contraction.

(137) Answer : (4)

Solution:

Medulla oblongata is the posterior most part of the brain and it is directly connected to the spinal cord.

(138) Answer : (3)

Solution:

In the image given,

A → PCT

D → Descending limb of Henle's loop

B → Thick segment of ascending limb of Henle's loop

C → DCT

In PCT, the filtrate is isotonic to the blood plasma. Ascending limb of Henle's loop is permeable to electrolytes.

(139) Answer : (2)

Hint:

This hormone is released in response to increase in blood pressure than normal.

Solution:

During dehydration (profuse sweating), osmolarity of body fluid increases, leading to increased secretion of ADH from hypothalamus. GFR decreases during profuse sweating.

(140) Answer : (1)

Solution:

Pancreas is a composite gland. Other than the kidneys, lungs, liver and skin also help in the elimination of excretory wastes.

(141) Answer : (4)

Solution:

GFR is the total volume of filtrate formed by both kidneys per minute. About 1% of filtrate is excreted as urine. GFR in a healthy individual is 125 mL/min or 7.5 L/hr or 180 L/day. Erythropoietin has no direct role in maintaining GFR.

(142) Answer : (3)

Hint:

Equidistant.

Solution:

Both actin and myosin are arranged as rod-like structures, parallel to each other and also to the longitudinal axis of the myofibrils.

(143) Answer : (4)

Solution:

Glenoid cavity is a depression which articulates with the head of the humerus.

(144) Answer : (2)

Solution:

Bipolar neurons have one distinct axon and a dendrite.

Multipolar neurons have numerous dendrites and one axon.

(145) Answer : (1)

Solution:

In myelinated nerve fibres, depolarisation occurs at the site where myelin sheath is absent, *i.e.*, at nodes of Ranvier.

(146) Answer : (3)

Solution:

Medulla oblongata is present in hindbrain and it controls involuntary breathing movements.

(147) Answer : (2)

Solution:

'I' band → Only thin filaments

H-zone → Contains only thick filaments

'Z' line acts as an anchoring membrane for actin filaments.

(148) Answer : (3)
Hint:
Head of meromyosin binds with actin filament.
Solution:
The head and short arm project outwards at regular distance and angle from each other from the surface of a polymerised myosin filament and is known as cross arm. Myosin binding sites are present on actin filaments.

(149) Answer : (2)
Solution:
Cross-bridge between actin and myosin will not break until a new ATP attaches to myosin head.

(150) Answer : (3)
Solution:
Fallopian tubes are lined by ciliated epithelium. Ciliary movements facilitate transport of ova across the fallopian tube.

(151) Answer : (1)
Solution:
A – Cartilage has pliable matrix due to presence of chondroitin salts.
B – Bone has non-pliable matrix due to presence of calcium salts.

(152) Answer : (1)
Solution:
A-band does not change in dimension during muscle contraction.

(153) Answer : (2)
Solution:
Cartilaginous joints – Bones involved are joined together with the help of a cartilage.
Fibrous joints – Contain dense fibrous connective tissue.

(154) Answer : (3)
Solution:
Uric acid : Insects, birds and terrestrial reptiles.
Urea : Humans

(155) Answer : (1)
Hint:
Also called false ribs
Solution:
In humans, the 8^{th}, 9^{th} and 10^{th} pairs of ribs do not articulate directly with the sternum but join the seventh rib with the help of hyaline cartilage. These are called vertebrochondral (false) ribs.

(156) Answer : (4)
Hint:
Part of appendicular skeleton
Solution:
Sacrum and coccyx are fused vertebral bones. Coxal bones make up the pelvic girdle. Each coxal bone is formed by the fusion of three bones – ilium, ischium and pubis. Each forelimb possesses 8 carpals. Carpals are the wrist bones.

(157) Answer : (1)
Solution:
Cellophane membrane is impermeable to macromolecules such as plasma proteins, but permeable to small solutes such as urea, uric acid, creatinine and mineral ions.

(158) Answer : (4)
Solution:
Sympathetic stimulation, like during exercise or haemorrhage, vasoconstriction of afferent arterioles predominates causing lowering of GFR.
Low renal blood flow activates RAAS. Enhanced renal reabsorption results in decreased urine volume.

(159) Answer : (1)
Solution:
Synaptic cleft – Facilitates neural communication by allowing Ach to diffuse across it
Neurotransmitters – These are chemicals which help in conversion of electrical signals into chemical signals
Electrical synapse – Does not use neurotransmitters, hence faster than chemical synapse.
Post-synaptic neurons – They receive signals that can produce either excitatory or inhibitory potentials.

(160) Answer : (3)
Solution:

Blood's hydrostatic pressure is the primary force driving filtration, pushing fluid and small solutes out of the glomerular capillaries (in the kidneys) into Bowman's capsule, while opposing forces are because of the fluid already present in the Bowman's capsule which exerts negative pressure; blood osmotic pressure is due to the proteins present in the blood.

(161) Answer : (2)
Solution:
Kidney secretes calcitriol, which is needed for adequate calcium reabsorption from the small intestine. So, renal failure may lead to decrease in blood Ca^{++} level. Renal failure causes edema (fluid retention). Renal failure can lead to hyperkalemia. In this, the kidney's ability to excrete the daily acid load to ammonium is impaired, leading to metabolic acidosis.

(162) Answer : (1)
Solution:
Synthesis of urea is the role of liver.

(163) Answer : (3)
Solution:
Pressure in glomerular capillaries is high as efferent arteriole is smaller in diameter than the afferent arteriole.

(164) Answer : (3)
Solution:
Nephridia help to remove nitrogenous wastes in earthworms and other annelids.
Antennal glands or green glands perform the excretory function in crustaceans like prawns.

(165) Answer : (2)
Solution:
(Filtration rate – Reabsorption rate) + Secretion rate = Urine excretion rate

(166) Answer : (2)
Solution:
The process of micturition is initiated by stretch receptors present in the wall of urinary bladder.

(167) Answer : (2)
Solution:
An action potential has two main phases, a depolarising phase and a repolarising phase. A stimulus makes the neuron's membrane potential less negative due to Na^{+} influx and then during repolarization, K^{+} flows out of the cell, making the inside negative again and bringing the resting potential back.

(168) Answer : (1)
Solution:
The cerebellum integrates the information received from the semi-circular canals of the ear and the auditory system.

(169) Answer : (4)
Solution:
The cerebral aqueduct is a passage that connects the hollow portions of the brain called ventricles, allowing CSF to flow between them. It passes through the midbrain.

(170) Answer : (3)
Hint:
Potential difference across the membrane
Solution:
Neurons are excitable cells because their membranes are in a polarised state. Neurons have only one axon but may have more than one dendrites.

(171) Answer : (2)
Solution:
The blood vessels of humans contain smooth muscle fibres. They are non-striated, involuntary, uninucleated and has fusiform shape.

(172) Answer : (4)
Solution:
Troponin and tropomyosin provide a calcium sensitive "switch" to control muscle contraction, as both of them are regulatory proteins.

(173) Answer : (4)
Solution:
Myasthenia gravis is an auto-immune disease that causes chronic and progressive damage to the neuro-muscular junctions. The immune system inappropriately produces antibodies that bind to and block Ach receptors, thereby decreasing the number of functional Ach receptors.
Dystrophin gets damaged in muscular dystrophy.

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(174) Answer : (1)
Solution:
Humans have one pectoral girdle that contains two glenoid cavities.
Each thick filament is composed of many meromyosin molecules.

(175) Answer : (1)
Solution:
Cranial bones = 8
Hyoid bone = 1
Tarsals in one limb = 7
Carpals in one limb = 8
Facial bones = 14
Ear ossicles = 6

(176) Answer : (2)
Solution:
Ear ossicle – Incus
Facial bone – Mandible
Cranial bone – Ethmoid
Skull bone – Sphenoid
Coxal bone – Ischium

(177) Answer : (3)
Solution:
Flat bones of skull contains fibrous joint. Temporal bone articulates with mandibular condyle by hinge/condyloid joint.

(178) Answer : (2)
Solution:
Red muscle fibres (RMF) are small in diameter. RMF are dark red due to large amount of myoglobin. These fibres are slow oxidative fibres which rely on aerobic respiration. These are adapted for maintaining posture and for endurance type activities like running a marathon.

(179) Answer : (1)
Solution:
Patella, fibula, ulna, clavicle and scapula are a part of our appendicular skeleton. Sternum, floating ribs and sacrum are included under the axial skeleton.

(180) Answer : (2)
Solution:
Total = 206 bones in an adult human
Axial skeleton = 80 bones
Appendicular skeleton = 126 bones

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