20/01/2024

Code-A_Phase-1

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MM : 720 NCERT Booster Test Series-RM(P1)2324-T03A **Time : 200 Min.**

PHYSICS

SECTION-A

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SECTION-B

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CHEMISTRY

SECTION-A

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SECTION-B

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BOTANY

SECTION-A

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SECTION-B

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ZOOLOGY

SECTION-A

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SECTION-B

186. (3)

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188. (1)

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191. (4)

192. (1)

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194. (1)

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196. (1)

197. (1)

198. (2)

199. (4)

200. (3)

Hints and Solutions

PHYSICS

SECTION-A

(1) **Answer :** (4)
Solution:
Moment of inertia depends on position of masses and distribution of its masses but not on angular speed.

(2) **Answer :** (1)
Solution:
$a_1 = \frac{F}{m_1}$
$a_2 = \frac{F}{m_2}$
$\frac{a_1}{a_2} = \frac{m_2}{m_1} = \frac{4}{1}$

(3) **Answer :** (4)
Hint:
Parallel axis theorem $I = I_{com} + md^2$
Solution:
$mk^2 = \frac{2}{3}mr^2 + md^2 = mr^2$
$\Rightarrow \frac{2}{3}mr^2 + md^2 = mr^2$
$d = \frac{r}{\sqrt{3}}$

(4) **Answer :** (1)

(5) **Answer :** (3)
Solution:
$\Delta U = \frac{mgh}{\left(1+\frac{h}{R}\right)}$ here, $h = 3R$
$\Delta U = \frac{3mgR}{(1+3)} = \frac{3}{4}mgR$

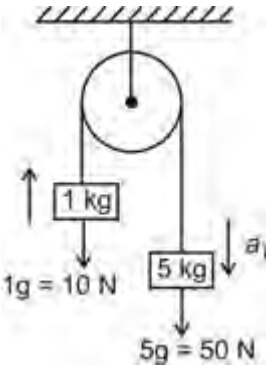
(6) **Answer :** (3)
Solution:
$\frac{\Delta v}{v} = \frac{-P}{B} = \frac{1000\times10^5}{35\times10^9} = \frac{100}{35}\times10^{-3}$
= 0.003

(7) **Answer :** (2)
Solution:
A couple will produce net torque but net force of couple is zero.

(8) **Answer :** (4)
Solution:
$\vec{\tau} = \vec{r} \times \vec{F} \Rightarrow \vec{\tau} \perp \vec{r}$ and $\vec{\tau} \perp \vec{F}$
Also, $\vec{\tau} \parallel \vec{\alpha}$
As $\vec{\tau} \parallel \vec{a} \quad \therefore \vec{\tau} \cdot \vec{a} > 0$
Also, $\vec{\tau} \times \vec{a} = 0$
As $\vec{F} \perp \vec{\tau} \therefore \vec{F} \cdot \vec{\tau} = 0$

(9) **Answer :** (4)
Solution:
$X_{cm} = \frac{\Sigma m_i x_i}{\sigma m_i} = 0$

(10) **Answer :** (3)
Solution:
$\vec{a}_{com} = \frac{m_1\vec{a}_1 + m_2\vec{a}_2}{m_1+m_2}$ and $\vec{a}_1 = -\vec{a}_2$
Net force on the given system



$F_{net} = 5g - 1g = 4g$

Acceleration, $a = \frac{F_{net}}{6}$

$= \frac{4g}{6} = \frac{2g}{3}\ \mathrm{m/s^2}$

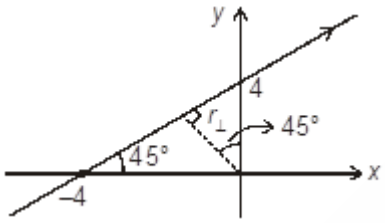
$\therefore a_{com} = \frac{5\left(\frac{-2g}{3}\right)+1\left(\frac{2g}{3}\right)}{5+1}$

$\Rightarrow$ Acceleration of c.o.m. with respect to ground is $a_{cmm} = -\frac{8g}{3} \times \frac{1}{6} = -\frac{4g}{9}$

$=$ Acceleration of c.o.m. w.r.t. 5 kg block is

$\Rightarrow a_{com\ /5\ kg} = -\frac{4g}{9} - \left(\frac{2g}{-3}\right) = \frac{2g}{9}$

(11) **Answer :** (2)
Solution:



$|L| = mv \times r_\perp$

$L = mv \times 2\sqrt{2}$

$\overrightarrow{L} = 2\sqrt{2}mv(-\hat{k})$

(12) **Answer :** (3)
Solution:

$\frac{l}{r} = \frac{l}{r_1} - \frac{l}{r_2}$

(13) **Answer :** (2)

(14) **Answer :** (2)
Solution:

$v_T = \frac{2}{9}\frac{r^2(\rho-\sigma)}{\eta}g$

$v_T \propto r^2$

(15) **Answer :** (4)

(16) **Answer :** (2)
Solution:

$\frac{dl}{dx} = 0 \Rightarrow 2x - 24 = 0$

$x = 12$

(17) **Answer :** (3)
Solution:

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$

$\frac{200}{A_1} = \frac{F_2}{4A_1}$

$F_2 = 800$ kg-wt

(18) **Answer :** (1)
Solution:

$V_S - V_C = V_{S'} - V_C'$

$-\frac{Gm}{R}+\frac{3Gm}{2R}=0-V_C$

$V_C=-\frac{Gm}{2R}$

(19) **Answer :** (3)
Solution:
First apply $A_1\,V_1=\ A_2V_2$ and get 'V_2' $=4\,\mathrm{m\ s^{-1}}$.
Next apply Bernoulli's theorem, $P_1+\frac{1}{2}\rho {v_1}^2=P_2+\frac{1}{2}\rho {v_2}^2$
Note that the pipe is horizontal

(20) **Answer :** (1)

(21) **Answer :** (3)
Solution:
$\frac{\Delta V}{V}\times 100=0.2\%$
$B = 9.8 \times 10^8$ N/m^2
$B=\frac{\Delta P}{-\left(\frac{\Delta V}{V}\right)}=\frac{hdg}{-\left(\frac{\Delta V}{V}\right)}$
$h=\frac{B\left(\frac{\Delta V}{V}\right)}{dg}=\frac{9.8\times10^8\times0.002}{1\times10^3\times9.8}=200\ \mathrm{m}$

(22) **Answer :** (1)
Solution:
$F=\frac{K}{r}=\frac{mv^2}{r}$
$v=\sqrt{\frac{k}{m}}$
i.e. independent of "*r*"

(23) **Answer :** (1)
Hint:
$Y=\frac{F}{A}\frac{\ell}{\Delta\ell}=\frac{F}{V}\frac{\ell^2}{\Delta\ell}$
[*Y* and Δ*l* are same]
Solution:
$F\propto\frac{1}{\ell^2}$
$\frac{F_1}{F_2}=\left(\frac{\ell_2}{\ell_1}\right)^2=\frac{\left(\ell+\frac{\ell}{2}\right)^2}{(\ell)^2}$
$F_2=\frac{4}{9}F$

(24) **Answer :** (1)

(25) **Answer :** (2)
Solution:
Apparent weight = *mg* – *B*
⇒ 8 = 10 – *B*
⇒ *B* = 2 N

(26) **Answer :** (4)

(27) **Answer :** (1)
Solution:
COM always follows parabolic path in all cases.

(28) **Answer :** (2)
Solution:
$Y=\frac{\left(\frac{F}{A}\right)}{0.001}$

(29) **Answer :** (2)

(30) **Answer :** (2)
Solution:
$I_{\text{half disc}}=\frac{1}{2}\,I_{\text{complete disc}}=\frac{1}{2}\times\frac{(2m)(r)^2}{4}=\frac{mr^2}{4}$

(31) **Answer :** (1)
Solution:
$\frac{m\times a+2m\times y_2}{3m}=y_{\text{cm}}$

$\Rightarrow y_{cm} = 0 \Rightarrow y_2 = \frac{-a}{2}$

(32) Answer : (3)
Solution:
$\vec{F} = 4\hat{i} - 5\hat{j} + 3\hat{k}$
$\bar{r}_{1/2} = \bar{r}_1 - \bar{r}_2$
Vector $\bar{r}_{1/2}$ is the position vector of 1 w.r.t. 2
$\Rightarrow \vec{r}_{1/2} = -2\hat{i} + 4\hat{j} + 6\hat{k}$
$\overrightarrow{\tau}_{\text{about 2}} = \overrightarrow{r}_{1/2} \times \overrightarrow{F}$
$\vec{\tau} = 42\hat{i} + 30\hat{j} - 6\hat{k}$

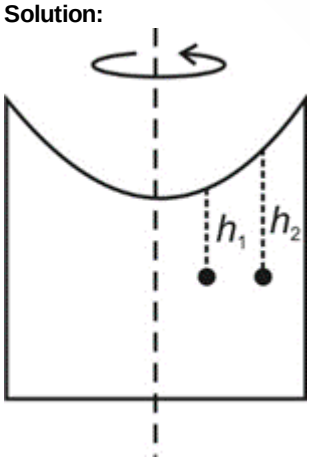
(33) Answer : (3)
Solution:
$Mx^2 + \frac{ML^2}{12} = \frac{ML^2}{10}$
$\Rightarrow x = \frac{L}{\sqrt{60}} = \frac{L}{2\sqrt{15}}$

(34) Answer : (1)
Solution:
$K_1 + U_1 = K_2 + U_2$
$0 + 0 = \left(\frac{P^2}{2m} + \frac{P^2}{2\times 2m}\right) - \frac{Gm\,2m}{r}$
$\frac{3P^2}{4m} = \frac{2Gm^2}{r} \quad \therefore \quad p = \sqrt{\frac{8Gm^3}{3r}}$
$v = \sqrt{\frac{8Gm}{3r}}$

(35) Answer : (4)
Solution:
Compressibility
$\boxed{\mathrm{k} \propto \frac{1}{\mathrm{B}}}$

SECTION-B

(36) Answer : (2)
Solution:



$h_2 > h_1$
$\therefore \quad \rho g h_2 > \rho g h_1$
$\therefore \quad P_2 > P_1$

(37) Answer : (2)

(38) Answer : (1)
Solution:
The equation of continuity of an ideal fluid flow in tube is based on law of conservation of mass.

(39) Answer : (3)
Solution:
$F_C = \frac{mv^2}{r}$
$\frac{\mathrm{k}}{\mathrm{r}^4} = \frac{\mathrm{mv}^2}{\mathrm{r}} \quad \Rightarrow \quad \mathrm{v}^2 \propto \frac{1}{\mathrm{r}^3} \quad \Rightarrow \quad \mathrm{v} \propto \frac{1}{\mathrm{r}^{3/2}}$

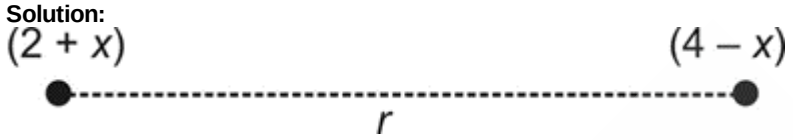
$T = \frac{2\pi r}{v} = \frac{2\pi r}{\frac{k}{r^{3/2}}} = \frac{2\pi}{k}\, r^{5/2}$

$T \propto r^{5/2}$

(40) **Answer :** (4)
Solution:
As there is no external force on system, So Centre of mass (boy + boat) remains stationary.

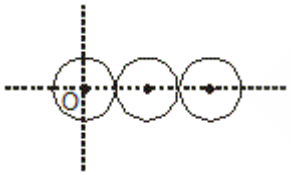
(41) **Answer :** (2)
Solution:
$\theta_1 = \frac{1}{2}\alpha(10)^2$
$\theta_1 + \theta_2 = \frac{1}{2}\alpha(20)^2$
$\frac{\theta_1+\theta_2}{\theta_1} = \frac{4}{1}$
$\therefore \theta_1 + \theta_2 = 4\theta_1$
$\theta_2 = 3\theta_1$
$\therefore \frac{\theta_2}{\theta_1} = 3$

(42) **Answer :** (2)
Solution:



$F = \frac{G(2+x)(4-x)}{r^2}$
$\frac{dF}{dx} = \frac{G}{r^2}(-2x+2)$
$0 = x - 1$
$\boxed{x = 1 \text{ kg}}$

(43) **Answer :** (1)
Solution:



$X_{cm} = \frac{m_1x_1+m_2x_2+m_3x_3}{m_1+m_2+m_3}$
$= \frac{m(0)+m(2R)+m(4R)}{3m} = \frac{6mR}{3m} = 2R$

(44) **Answer :** (4)
Solution:
$\because \Delta P = P_{in} - P_0 = \frac{2T}{r}$
T → Surface tension
r → Radius of meniscus
$P_{in} = P_0 + \frac{2T}{r}$

(45) **Answer :** (1)

(46) **Answer :** (4)

(47) **Answer :** (4)

(48) **Answer :** (2)
Solution: B

(49) **Answer :** (4)

(50) **Answer :** (1)
Solution:
$g' = g\left(1 - \frac{d}{R}\right)$
$\Rightarrow \quad g' = \frac{99}{100}\, g$

CHEMISTRY

SECTION-A

(51) **Answer :** (1)
Solution:
$n_{HCl} = 10^{-4} \times \frac{100}{1000} = 10^{-5}$
$n_{NaOH} = 10^{-4} \times \frac{200}{1000} = 2 \times 10^{-5}$
$n_{Reacted} = 10^{-5}$
$n_{unreacted\ NaOH} = (2 \times 10^{-5} - 1 \times 10^{-5})$
$= 10^{-5}$
$M_{NaOH} = \frac{10^{-5}}{1} = 10^{-5}\ mol\ L^{-1}$
$[OH^-] = 10^{-5}$ mol L^{-1}
pOH = 5 [$\because$ pH + pOH = 14]
pH = 9

(52) **Answer :** (2)
Solution:
Reaction for which $\Delta n_g > 0$ will have $K_p > K_c$

(53) **Answer :** (3)
Solution:
$N_2 + 3\ H_2 \rightleftharpoons 2\ NH_3$ $K_{eq} = K$
$2\ NH_3 \rightleftharpoons N_2 + 3\ H_2$ $K_{eq} = \frac{1}{K}$
$NH_3 \rightleftharpoons \frac{1}{2}N_2 + \frac{3}{2}H_2$ $K_{eq} = \frac{1}{\sqrt{K}}$

(54) **Answer :** (2)
Solution:
$pOH = pK_b + \log \frac{[salt]}{[base]} = 5 + \log \frac{10}{1} = 6$

(55) **Answer :** (2)
Solution:
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
n = 2, d = $\frac{124}{2}$
= 62, D = $\frac{208.5}{2}$
= 104.25
$\therefore \quad \alpha = \frac{D-d}{(n-1)\,d} = \frac{104.25-62}{62} = 0.68$

(56) **Answer :** (2)
Solution:
$S_{(CaF_2)}$ = 1.56 × 10^{-3} g per 100 ml
= 2 × 10^{-4} moles L^{-1} ($\because M_{CaF_2} = 79$)
$K_{sp} = [Ca^{2+}]\,[F^-]^2$
$= (s)\,(2s)^2$
$= 4s^3$
$= 4(2 \times 10^{-4})^3$
$= 32 \times 10^{-12}$
$= 3.2 \times 10^{-11}$

(57) **Answer :** (2)
Solution:
$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
$K_P = pCO_2 = 1.1$
$n_{CO_2} = \frac{PV}{RT} = \frac{1.1 \times 10}{0.08 \times 1100} = 0.125$
n_{CaCO_3} = reacted = 0.125
W_{CaCO_3} reacted = n × M = 12.5 g
$CaCO_3$ remained unreacted = 20 – 12.5 = 7.5 g

% of $CaCO_3$ unreacted = $\frac{7.5}{20} \times \frac{100}{1} = 37.5\%$

(58) **Answer :** (3)
Solution:
$NH_2CO_2NH_4(s) \rightleftharpoons \underset{2x}{2NH_3(g)} + \underset{x}{CO_2(g)}$
$P_{NH_3} = \frac{2P}{3}, P_{CO_2} = \frac{P}{3}$
Where, P is the total pressure at equilibrium
$K_P = P_{NH_3}^2 \cdot P_{CO_2} = \frac{4P^3}{27} = 1.185$
P = 2 atm
$\therefore P_{NH_3} = \frac{2\times2}{3} = \frac{4}{3} = 1.33\,atm$
$P_{CO_2} = \frac{2}{3} = 0.66\,atm$

(59) **Answer :** (2)
Solution:
$X^-(aq) + H_2O(l) \overset{K_h}{\rightleftharpoons} HX(aq) + OH^-(aq)$
$K_h = \frac{K_w}{K_a} = \frac{10^{-14}}{10^{-5}} = 10^{-9}$

(60) **Answer :** (3)
Solution:
At equilibrium, concentrations of reactants and products become constant but may or may not be necessarily equal to each other.

(61) **Answer :** (3)
Solution:
$\Delta U = \Delta Q + \Delta W$
$\Delta Q = 0$
In adiabatic process ΔQ = 0 therefore ΔU = ΔW

(62) **Answer :** (3)
Solution:
q = Cm ΔT
= 0.9 × 21 × ($T_2 - T_1$)
= 0.9 × 21 × 100
= 1890 J

(63) **Answer :** (2)
Solution:
$CCl_4 \rightarrow$ C + 4Cl $\quad \Delta H_a$ = 450 kJ
∴ C – Cl bond energy = $\frac{450}{4}$ = 112.5 kJ
$COCl_2 \rightarrow$ C + O + 2Cl $\quad \Delta H_a$ = 600 kJ
Energy required to break the molecule
C = O bond + 2C – Cl = 600
C = O bond energy + 2 × 112.5 = 600
C = O bond energy = 600 – 225 = 375 kJ

(64) **Answer :** (3)
Solution:
NCERT Reference: Class XI, Part-I, Page No. 171

(65) **Answer :** (4)
Solution:
NCERT Reference: Class XI, Part-I, Page No. 165

(66) **Answer :** (3)
Solution:
(Reference NCERT Page No. -168)

(67) **Answer :** (4)
Solution:
· In free expansion P_{ext} = 0 therefore work done is zero.
· In case of expansion magnitude of $W_{reversible}$ is greater than $W_{irreversible}$
· Slope of P-V curve in adiabatic is greater than isothermal.

(68) **Answer :** (4)
Hint:
$|\Delta H_n|$ value is greater for stronger acid.
Solution:

Order of decreasing strength of acids is B > D > A > C.

(69) **Answer :** (4)
Hint:
Work done is path function.

(70) **Answer :** (1)
Hint:
Third law permits the calculation of absolute value of entropy of pure crystalline substance.

(71) **Answer :** (2)

(72) **Answer :** (4)
Solution:
Electrolysis of acidified water
At anode : $4OH^- \longrightarrow 2H_2O + O_2 + 4e^-$
At cathode : $2H^+ + 2e^- \longrightarrow H_2$
Overall reaction : $2H_2O \rightleftharpoons 2H_2 + O_2$

(73) **Answer :** (2)
Hint:
Reaction in which same element oxidize as well as reduce is known as disproportionation.
Solution:
Sol. : Reaction, $NH_4NO_3 \rightarrow N_2O + 2H_2O$, is reverse of disproportionation, known as comproportionation reaction.

(74) **Answer :** (3)
Hint:
For neural molecules, net charge = 0.
Solution:
$Na_2S_2O_3 \Rightarrow 2 \times 1 + 2 \times a + 3x(-2) = 0 \Rightarrow a = 2$
$SF_6 \Rightarrow a + 6x(-1) \Rightarrow a = 6$
$SO_2 \Rightarrow a + 2x(-2) \Rightarrow a = 4$

(75) **Answer :** (3)
Hint:
Balance the atoms as well as charge.
Solution:
$2\,MnO_4^- + 10I^- + 16H^+ \rightarrow 2\,Mn^{2+} + 5I_2 + 8H_2O$

(76) **Answer :** (3)

(77) **Answer :** (1)
Solution:
$Mn^{7+} + 5e^- \quad \rightarrow \quad Mn^{2+}$

(78) **Answer :** (3)
Solution:
NCERT Reference: XII, Page No. 81-82

(79) **Answer :** (2)
Hint:
Molar conductivity for strong electrolyte is given by Debye-Huckel equation
Solution:
$\lambda_m = \lambda_m^o - A\sqrt{C}$
$\therefore\ \lambda_m^o = \lambda_m + A\sqrt{C}$

(80) **Answer :** (1)
Solution:
$\Lambda_m^o\left(Mg(OH)_2\right) = \lambda^o_{Mg^{2+}} + 2\lambda^o_{OH^-}$
= 106 + 2 × (199.1)
= 504.2 S cm^2 mol^{-1}

(81) **Answer :** (1)
Solution:
$\alpha = \frac{\lambda_m}{\lambda_m^o} = \frac{19.5}{349.1+40.9} = 0.05$

(82) **Answer :** (4)

(83) Answer : (4)

(84) Answer : (3)
Solution:
m = Zit
$= \frac{108}{96500} \times 9.65 \times 1000$
= 10.8 g

(85) Answer : (2)
Solution:

Ag : Cu : Al

$\frac{\text{No. of Faradays passed}}{\text{No. of Faradays needed}}$

$\frac{3}{1} : \frac{3}{2} : \frac{3}{3}$

$\Rightarrow 3 : \frac{3}{2} : 1$

$\Rightarrow 6 : 3 : 2$

$Ag^{\oplus} + e^{\ominus} \longrightarrow Ag$
1F needed

$Ca^{2+} + 2e^{\ominus} \longrightarrow Cu$
2F needed

$Al^{3+} + 3e^{\ominus} \longrightarrow Al$
3F needed

SECTION-B

(86) Answer : (4)
Solution:
$\Delta G^\circ = -nF E^\circ_{cell}$
= – 2 × 96500 × 1.05
= – 202650 J mol^{-1}
= – 202.65 kJ mol^{-1}

(87) Answer : (1)
Solution: $\log K_{eq} = \frac{nE^\circ_{OUII}}{0.0591}$

(88) Answer : (1)
Solution:
In mercury cell cathode used is paste of HgO and carbon.

(89) Answer : (2)
Solution:
H_2–O_2 fuel cell:
$2H_2(g) + O_2(g) \longrightarrow 2H_2O(\ell)$

(90) Answer : (4)
Solution:
ΔG°= –2.303 RT log K
= –2.303 × 8.314 × 300 log 1000
= –17232.4 J = –17.2 kJ

(91) Answer : (1)
Solution:
$\Delta S = \frac{\Delta H_f}{T} = \frac{3000}{300} = 10 \text{ J } g^{-1}K^{-1}$

(92) Answer : (4)
Solution:
$\Delta S_{surr} = \frac{-\Delta H_{sys}}{T}$

(93) Answer : (1)
Solution:
$\Delta U = q + w$
If q = 0 then $\boxed{\Delta U = w}$

(94) **Answer :** (4)
Solution:
[C(s) + $O_2 \rightarrow CO_2 + X$]
– [$2CO + O_2 \rightarrow 2CO_2 + Y$] × $\frac{1}{2}$
$C(s) + \frac{1}{2}O_2 \rightarrow CO + X - \frac{Y}{2}$
$\therefore \Delta H = -\left(X - \frac{Y}{2}\right)$

(95) **Answer :** (4)
Solution:
$Fe^{2+} + Cr_2O_7^{2-} \rightarrow Fe^{3+} + 2Cr^{3+}$
$6Fe^{2+} + Cr_2O_7^{2-} \rightarrow 6Fe^{3+} + 2Cr^{3+}$
$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+$
$\rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$
$x = 6,\ y = 1,\ z = 14$

(96) **Answer :** (2)
Solution:
Oxidation state of Mn in MnO_4^{2-} is +6.

(97) **Answer :** (1)
Solution:
Fact

(98) **Answer :** (2)
Solution:
Solution of weak acid and its salt with strong base is known as acidic buffer.

(99) **Answer :** (1)
Solution:
Let the solubility of $Ca(OH)_2$ be s mol/L

$Ca(OH)_2 \rightleftharpoons \underset{s}{Ca} + \underset{2s}{2OH^-}$

$K_{sp} = [Ca^{2+}][OH^-]^2$
$4 \times 10^{-6} = (s)(2s)^2$
$4 \times 10^{-6} = 4s^3$
$s^3 = 10^{-6}$
$s = 10^{-2}$
$[OH^-] = 2 \times 10^{-2}$
$pOH = -\log(2 \times 10^{-2})$
$= 1.7$
$pH = 14 - 1.7$
$= 12.3$

(100) **Answer :** (3)
Solution:
In an equilibrium, all the reactants and the products are present in the same phase, it is called homogeneous equilibrium.
$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

BOTANY

SECTION-A

(101) **Answer :** (3)
Solution:
Xylem fibres are dead.

(102) **Answer :** (1)
Solution:
Intercalary meristem is a primary meristem.

(103) **Answer :** (4)
Solution:
In grasses, stomata have dumb-bell shaped guard cells.

(104) Answer : (3)
Solution:
Answer (3)

(105) Answer : (3)
Solution:
Vascular cambium is a secondary meristem.

(106) Answer : (3)
Solution:
(i) Secondary growth takes place in the roots of Dicots and Gymnosperms.
(ii) Events are similar to those in stems.

(107) Answer : (3)

(108) Answer : (1)
Solution:
Root hairs are the epidermal appendages of roots. They arise from the cells of epidermis.

(109) Answer : (2)
Solution:
Suberin deposited barrel shaped cells are found in endodermis of roots.

(110) Answer : (3)
Solution:
Tracheids and vessels both are dead, lignified and water conducting part of xylem. Vessels have perforated end plates.

(111) Answer : (2)
Solution:
Relative positions of primary xylem (Protoxylem & metaxylem) decides the endarch or exarch conditions. In endarch arrangement, protoxylem occurs towards centre and metaxylem towards periphery.

(112) Answer : (4)
Solution:
In roots, protoxylem lies towards periphery and metaxylem lies towards centre.

(113) Answer : (3)
Solution:
Companion cell help in maintaining pressure gradient in the sieve tubes. A mature sieve element possesses a peripheral cytoplasm and large vacuole but lacks nucleus. Phloem fibres have pointed needle like apices. Phloem parenchyma stores resins, tannins, mucilage, latex, etc.

(114) Answer : (3)
Solution:
In red algae (*e.g. Gracilaria*), complex post-fertilization developments occur.

(115) Answer : (2)
Solution:
Cycas is a dioecious i.e. male and female plants are separate. These are without branching.

(116) Answer : (2)
Solution:
Cytotaxonomy does not includes DNA sequencing to identify or classify organisms.

(117) Answer : (4)
Solution:
Seeds in gymnosperms are naked.
In gymnosperms due to absence of fruit, seeds are not covered in fruit wall.

(118) Answer : (1)
Solution:
Fucus has diplontic life cycle.

(119) Answer : (1)
Solution:
In some pteridophytes such as *Selaginella* and *Equisetum*, sporophylls may form distinct compact structures called strobili or cones.

(120) Answer : (2)
Solution:
Bentham and Hooker proposed natural system of classification.

(121) Answer : (4)
Solution:
Sargassum is a brown alga.

(122) Answer : (2)
Solution:
Vegetative propagation in *Funaria* occurs through fragmentation in secondary protonema.

(123) Answer : (3)
Solution:
Gametophytes of pteridophytes require cool, damp and shady places to grow.

(124) Answer : (1)
Solution:
Gymnosperms are archegoniate phanerogams while angiosperms are non-archegoniate phanerogams.
Pinus and *Cycas* – Produce seeds and have archegonia.
Funaria, *Selaginella* – Have archegonia but lack seeds.
Mustard – Have seeds but lack archegonia.

(125) Answer : (3)
Solution:
Phaeophyceae members store food in the form of mannitol.
Chlorophyll a and *d* are major pigments of members of Rhodophyceae

(126) Answer : (3)
Hint:
Leaves in *Selaginella* are small and called microphylls.
Solution:
Dryopteris produces single kind of spores and so it is homosporous. Coralloid roots are found in *Cycas.*
Mycorrhizal association is seen in *Pinus*.

(127) Answer : (4)
Solution:
In brown algae, the vegetative cells have a cellulosic wall usually covered on the outside by a gelatinous coating of algin.

(128) Answer : (3)
Solution:
Mosses have multicellular and branched rhizoids. The sporophyte in moss is more elaborate than that in liverworts. The mosses have an elaborate mechanism of spore dispersal.

(129) Answer : (3)
Solution:
Numerical Taxonomy which is now easily carried out using computers is based on all observable characteristics.

(130) Answer : (3)
Solution:
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(131) Answer : (2)
Solution:
Half of the total CO_2 fixation on the earth is carried out by algae through photosynthesis.

(132) Answer : (2)
Solution:
(i) Agar is commercially obtained from *Gelidium* and *Gracillaria*.
(ii) Agar is used to grow microbes & to prepare ice-creams & jellies.

(133) Answer : (1)
Solution:
The spores in pteridophytes germinate to give rise to inconspicuous, small but multicellular, free-living, mostly photosynthetic thalloid gametophytes called prothallus.

(134) Answer : (1)
Solution:
One of the gymnosperms, the giant redwood tree *Sequoia* is one of the tallest tree species.

(135) Answer : (1)
Hint:
Mosses along with lichens are the first organisms to colonise on rocks.
Solution:
Bryophytes in general are of little economic importance but are of great ecological importance.

SECTION-B

(136) Answer : (1)
Solution:
Protonema is the creeping, branched, juvenile stage of moss.

(137) Answer : (3)
Solution:
Phellogen (cork-cambium), phellem (cork) and phelloderm (secondary cortex) are collectively called periderm.

(138) Answer : (4)

(139) Answer : (4)
Solution:
All the tissues inner to endodermis are a part of stele.

(140) Answer : (2)
Solution:
Tissue is a group of cells having common origin, common or correlated function. Structurally they can be similar or dissimilar. They can be meristematic or permanent.

(141) Answer : (3)
Solution:
Tetrarch and radial vascular bundle is found in dicot root.

(142) Answer : (4)
Solution:
Sclerenchyma differs from collenchyma in being dead at maturity.

(143) Answer : (3)
Solution:
Fossils are used in phylogenetic classification system.

(144) Answer : (1)
Solution:
Given life cycle is diplontic type of life cycle.

(145) Answer : (1)
Solution:
Algin is produced by brown algae. *Chara* is a green alga and reproduces sexually.

(146) Answer : (3)
Solution:
Lycopsida – *Selaginella* and *Lycopodium*
Sphenopsida – *Equisetum*
Pteropsida – *Dryopteris*, *Pteris* and *Adiantum*

(147) Answer : (3)
Solution:
Gemma cups are asexual buds present in *Marchantia*.

(148) Answer : (3)
Solution:
Wolfia is the smallest angiosperm.

(149) Answer : (4)
Solution:
Agar is obtained from red algae.
Gonyaulax is a dinoflagellate (Protist).

(150) Answer : (3)
Solution:
Bryophytes are called Amphibians of plant kingdom.

ZOOLOGY

SECTION-A

(151) Answer : (4)
Solution:
A – Efferent arteriole
B – Glomerulus lined by endothelium
C – Henle's loop – minimum reabsorption occurs in its ascending limb

(152) Answer : (1)
Hint:
Removal of this compound requires large amount of water.
Solution:

Ammonia is the most toxic nitrogenous waste and uric acid is the least toxic nitrogenous waste which is excreted in the form of pellets.

(153) Answer : (3)
Hint:
Site for maximum reabsorption of electrolytes and water.
Solution:
In PCT, maximum reabsorption of solutes and water occurs with the help of brush bordered cuboidal epithelium that create increased surface area for reabsorption

(154) Answer : (2)
Solution:
Urea synthesis is not a step of urine formation.

(155) Answer : (3)
Hint:
This hormone is stored in neurohypophysis.
Solution:
Stored antidiuretic hormone released by posterior pituitary and helps in facultative reabsorption of water in distal parts of nephron.

(156) Answer : (3)
Solution:
Juxtaglomerular apparatus is formed by cellular modifications of DCT and afferent arteriole at the location of their contact.

(157) Answer : (2)
Hint:
Mostly terrestrial animals.
Solution:
Ammonotelic – Bony fishes, aquatic amphibians, aquatic insects.
Uricotelic – Reptiles, birds, land snails and insects.

(158) Answer : (3)
Hint:
Blood capillaries of medulla are vasa recta.
Solution:
The loop of Henle of cortical nephrons do not reach deep into pyramids. Vasa recta are well developed in JG nephrons.

(159) Answer : (2)
Solution:
Tubular secretion is an important step of urine formation. It is helpful in maintenance of ionic and acid-base balance of body. Selective secretion of hydrogen and K^+ occurs in DCT and collecting duct.

(160) Answer : (3)
Solution:
Urea enters loop of Henle from medullary interstitium.
Collecting duct also plays a role in the maintenance of pH and ionic balance of blood by the selective secretion of H^+ and K^+ ions.

(161) Answer : (1)
Hint:
Secretion of substances in the filtrate.
Solution:
H^+, and $NH_3$are secreted in PCT and H^+, K^+ and NH_3 are secreted in DCT. Urea is secreted in ascending limb of loop of Henle which is transported back to interstitium by collecting duct.

(162) Answer : (4)
Solution:
Urine concentration is based on the length of loop of Henle.
Presence of longer loop of Henle is characteristic feature of mammalian kidneys.

(163) Answer : (4)
Solution:
Ketone bodies are found in the urine of diabetes patients, due to lysis/breakdown of fats

(164) Answer : (2)
Hint:
Collecting ducts enter medulla and joins to form ducts of Bellini.
Solution:
Hilum is a notch through which ureter, blood vessels and nerve enter kidney.
Major calyces open into a broad funnel-shaped structure called renal pelvis.

(165) Answer : (2)
Solution:
Contraction of muscle fibre takes place by sliding of thin filaments over thick filaments.

(166) Answer : (2)
Solution:
Skeletal muscle is innervated by nerve fibres of somatic nervous system.

(167) Answer : (2)
Hint:
This bone supports the weight of human head.
Solution:
The 9th and 10th pairs of ribs are called vertebrochondral ribs. Each half of pectoral girdle comprises of one clavicle and one scapula. The number of sacral vertebrae changes from 5 to 1 from foetus to adult stage.

(168) Answer : (2)
Solution:
The two halves of pelvic girdle meet ventrally to form the pubic symphysis containing white fibrous cartilage.

(169) Answer : (4)
Hint:
Movement in one plane occurs in hinge joint.
Solution:
Gliding joint – Between carpals
Hinge joint – Between femur and tibia
Pivot joint – Between atlas and axis
Ball and socket joint– Between humerus and pectoral girdle

(170) Answer : (3)
Solution:
Sternum is associated with axial skeleton.

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

(172) Answer : (4)
Solution:
Total number of carpals in upper limbs are 16 in number.

(173) Answer : (3)
Solution:
Some of the muscles possess very less quantity of myoglobin and therefore, appear pale or whitish. These are the white fibres. Number of mitochondria are also few in them, but the amount of sarcoplasmic reticulum is high. They depend on anaerobic respiration for energy.

(174) Answer : (3)
Solution:
Locomotion requires a perfect coordinated activity of muscular, neural and skeletal systems.

(175) Answer : (4)
Hint:
Identify a unpaired bone of skull.
Solution:
Sphenoid is an unpaired cranial bone while zygomatic, nasal and lacrimal are paired facial bones.

(176) Answer : (2)
Solution:
Hydra uses its tentacles for capturing prey as well as in locomotion

(177) Answer : (3)
Solution:
Involuntary muscles lines the hollow organs such as intestine.

(178) Answer : (3)
Solution:
The sarcoplasmic reticulum is a store house of calcium ions in voluntary muscle fibres.

(179) Answer : (1)
Solution:
Brain stem forms the connection between brain and spinal cord. The major regions that make up the brain stem are mid brain, pons and medulla oblongata.

(180) Answer : (1)
Hint:

Corpora quadrigemina are four round swellings found in the dorsal portion of midbrain.
Solution:
A deep cleft divides the cerebrum of forebrain longitudinally into two halves right and left cerebral hemispheres.
The corpus callosum is a large C-shaped nerve fibre bundle found beneath the cerebral cortex. It is responsible for transmitting neural messages between both right and left hemispheres.

(181) Answer : (3)
Solution:
The ionic gradients across the resting membrane are maintained by the active transport of ions by the sodium-potassium pump which transports 3 Na^+ outwards for 2 K^+ into the cell.

(182) Answer : (4)
Solution:
Skeletal muscles are supplied by somatic neural system.

(183) Answer : (3)
Solution:
Pia mater is inner most meninx.

(184) Answer : (4)
Solution:
Nerve impulse travels as electric impulse

(185) Answer : (3)
Solution:
Medulla oblongata is the gastric secretion control centre. Pneumotaxic centre is present in pons.

SECTION-B

(186) Answer : (3)
Solution:
In *Periplaneta*, tracheal tubes are respiratory organ and Malpighian tubules are excretory organ. Flame cells are excretory structures in flatworms.

(187) Answer : (4)
Solution:
Uremia is the increased levels of urea in the blood.

(188) Answer : (1)
Hint:
Conditional reabsorption.
Solution:
Angiotensin II activates the adrenal cortex to release aldosterone, which causes reabsorption of Na^+ and water from DCT.

(189) Answer : (1)
Solution:
Sweat produced by sweat glands is a watery fluid containing NaCl, small amount of urea, amino acids and glucose, etc.

(190) Answer : (1)
Hint:
Almost all the glomerular filtrate is reabsorbed by the renal tubules.
Solution:
The tubular epithelial cells in different segments of nephron carry out reabsorption either by active or passive mechanisms. For example, substances like glucose, amino acids, Na^+, *etc*. in the filtrate are reabsorbed actively, whereas nitrogenous wastes are reabsorbed by passive transport.

(191) Answer : (4)
Solution:
Ascending limb of loop of Henle being permeable to electrolytes and impermeable to water makes the filtrate hypo-osmotic to plasma.

(192) Answer : (1)
Solution:
Scapula is triangular flat bone of pectoral girdle situated on dorsal side of the thorax in between the 2^{nd} and 7^{th} ribs.

(193) Answer : (2)
Solution:
Cervical and lumbar vertebrae are not parts of rib cage.

(194) Answer : (1)

Solution:
Gout is due to accumulation of uric acid in joints. Osteoporosis – decreased bone mass
Muscular dystrophy – progressive degeneration of skeletal muscles.

(195) Answer : (4)
Solution:
Tropomyosin and troponin are regulatory proteins. Tropomyosin runs close to the 'F' actins throughout its length. Troponin is distributed at regular intervals on the tropomyosin.

(196) Answer : (1)
Solution:
Nissl's granules are present in cyton and dendrites of a neuron.

(197) Answer : (1)
Solution:
The gaps between two adjacent myelin sheaths are called nodes of Ranvier. When a stimulus is applied at a site on the polarised membrane, the membrane at the site becomes freely permeable to Na^+. This leads to a rapid influx of Na^+ followed by the reversal of the polarity at that site, *i.e*., the outer surface of the membrane becomes negatively charged and the inner side becomes positively charged.

(198) Answer : (2)
Solution:
Hint : Structures associated with projecting ridge in the saccule and utricle.
Sol. : The otolith organ maintains the static balance of the body. Otolith organ consists of two structures *i.e.* saccule and utricle. The cristae in the three semicircular canals maintain the dynamic balance of the body. Both static as well as the dynamic balance are maintained by the vestibular apparatus.

(199) Answer : (4)
Solution:
Knel-jerk reflex is a monosynaptic reflex and lacks inter-neuron in its reflex arc.

(200) Answer : (3)
Solution:
Cones are densely packed in fovea.