25/03/2026

Code-B_(Phase-1)

Aakash
Medical | IIT-JEE | Foundations

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18,
Udyog Vihar, Gurugram, Haryana - 122015, ***Ph.***+91-1244168300

MM : 720 Final Test Series(P1)_NEET2026_Test-03B **Time : 180 Min.**

PHYSICS

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158. (2)

180. (1)

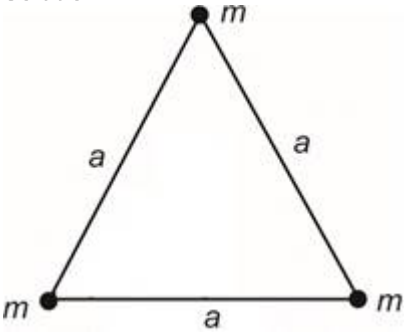
Hints and Solutions

PHYSICS

(1) **Answer :** (2)
Solution:
$V_S - V_C = V'_S - V'_C$
$-\frac{GM}{R} + \frac{3GM}{2R} = 0 - V'_C$
$V_c = -\frac{GM}{2R}$

(2) **Answer :** (4)
Solution:
Kepler's law of area is consequence of conservation of angular momentum

(3) **Answer :** (2)
Solution:



$U = \frac{-Gm^2}{a} - \frac{Gm^2}{a} - \frac{Gm^2}{a} = \frac{-3Gm^2}{a}$

(4) **Answer :** (4)
Solution:
• Total energy of circularly orbiting satellite is negative.
• For elliptical orbiting satellite, both K.E and P.E are of opposite sign.
• Satellite motion obeys Kepler's law of periods.
• Astronaut experiences weightlessness in a space satellite.

(5) **Answer :** (4)
Hint:

Escape velocity from surface of planet, $v_e = \sqrt{\frac{2GM_P}{R_P+h}}$

Solution:
v_e is independent of mass of the body (m) and angle of projection (θ).
v_e depends on mass of the planet (M_P) and height of projection.

(6) **Answer :** (1)
Solution:
$T^2 \propto r^3$
Since orbit radius is same for both
∴ Both have equal time period

(7) **Answer :** (1)
Solution:
$g_{\text{depth}} = g_{\text{height}}$
$g\left[1 - \frac{d}{R}\right] = g\left[1 - \frac{2h}{R}\right]$
$d = 2h$
$h = \frac{d}{2} = \frac{50}{2} = 25$ km

(8) **Answer :** (4)
Solution:

Acceleration due to gravity is a vector quantity.

(9) **Answer :** (1)
Solution:
Hooke's law is not applicable to elastomers.
Beyond elastic limit, the body undergoes plastic deformation.

(10) **Answer :** (2)
Solution:
Since the rods have the same length and cross-sectional area, the heat current ratio I_A : I_B is determined by the ratio of their thermal conductivities:
$\frac{I_A}{I_B} = \frac{K}{3K} = \frac{1}{3}$
Thus, the ratio of heat current in the rods is 1 : 3

(11) **Answer :** (3)
Solution:
If angle of contact is acute then liquid meniscus is concave upwards in shape.

(12) **Answer :** (1)
Solution:
rate = 0.5 $m^3 s^{-1}$, $A = 500 \times 10^{-4}$ m^2
$v = \frac{\text{rate}}{A} = \frac{0.5}{500 \times 10^{-4}} = 10 \text{ m s}^{-1}$

(13) **Answer :** (1)
Solution:
When a solid melts into liquid, its phase changes. It absorbs heat during this process.
$Q = mL$, where L is the Latent heat of phase change.

(14) **Answer :** (4)
Solution:

$Y = \frac{\text{Stress}}{\text{Strain}} \Rightarrow$ Slope of given graph is inversely proportional to young's modulus.

(15) **Answer :** (2)
Solution:
At the bottom, $P_1 = P_2 = P_3$, because depth is same in all the vessels.

(16) **Answer :** (1)
Solution:
Venturi meter works on Bernoulli's principle.

(17) **Answer :** (1)
Solution:
By increasing temperature, intermolecular forces decrease. Therefore almost in all metals the modulus of elasticity decreases with rise in temperature.

(18) **Answer :** (2)
Solution:
On heating volume of solid ball as well as volume of cavity increases.

(19) **Answer :** (2)
Hint:
Compressibility is defined as reciprocal of Bulk modulus.
Solution:
$[K] = \frac{1}{[B]} \quad \Rightarrow [K] = \frac{1}{\left[\text{ML}^{-1}\text{T}^{-2}\right]} \quad \Rightarrow \quad [K] = \left[\text{M}^{1}\text{L}^{1}\text{T}^{2}\right]$

(20) **Answer :** (2)
Solution:
Cosider a strip of thickness dx, at a depth x below and above distance x from hinge. Force due to liquid above hinge rotate clockwise and below anticlockwise in equilibrium
$\int_0^{\frac{1}{2}} \left(\frac{1}{2} + x\right) \rho g \left(dx\right) x - \int_0^{\frac{1}{2}} \left(\frac{1}{2} - x\right) \rho g x dx = F \times \frac{1}{4}$

$\rho g\left[\left(\frac{1}{16}+\frac{1}{24}\right)-\left(\frac{1}{16}-\frac{1}{24}\right)\right]=F\times\frac{1}{4}$

$\rho g\times\frac{1}{12}=F\times\frac{1}{4}$

$F=\frac{\rho g}{3}$

(21) Answer : (3)

Solution:

$F=\frac{GMM}{(2R)^2}=\frac{GM^2}{4R^2}$, 2*R* is distance between their centers.

(22) Answer : (3)

Solution:

$V_T=\frac{2}{9}\times\frac{a^2}{\eta}\times\left(\rho_b-\rho_f\right)\times g$

$\frac{9}{4}=\frac{r_1^2}{r_2^2}\ \Rightarrow\ \frac{r_1}{r_2}=\frac{3}{2}\ \Rightarrow\ \frac{V_1}{V_2}=\frac{27}{8}$

(23) Answer : (1)

Solution:

$U_i=-\frac{GMm}{R},\ T.E_F=-\frac{GMm}{2r},\ r=3R$

$T.E_F=-\frac{GMm}{6R}$

$-\frac{GMm}{R}+\Delta E=-\frac{GMm}{6R}\ \Rightarrow\ \Delta E=\frac{GMm}{R}\frac{5}{6}$

(24) Answer : (1)

Solution:

Heat lost = Heat gained

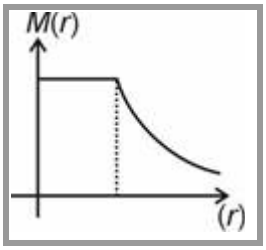
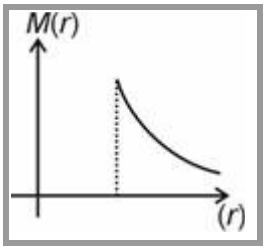
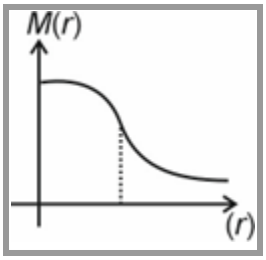
$\Rightarrow\ \rho_w\times0.1\times s\times(80-T)=\rho_w\times0.3\times s(T-60)$

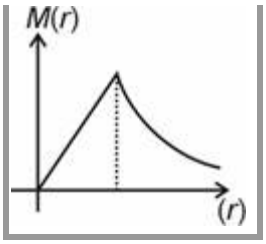
80 – *T* = 3*T* – 180 ⇒ 4*T* = 260

$T=\frac{260}{4}=65^\circ\text{C}$

(25) Answer : (1)

Solution:

	⇒	Potential due to spherical shell
	⇒	Field due to spherical shell
	⇒	Variation of gravitational potential due to a uniform solid sphere
	⇒	Variation of gravitational field due to uniform solid sphere



(26) **Answer :** (2)
Solution:
$V_{\text{efflux}} = \sqrt{2gH_2 sin\alpha}$
Time taken to reach ground $= \sqrt{\frac{2\times H_1 \sin\alpha}{g}}$
$R = \sqrt{2gH_2 \sin\alpha \times \frac{2\times H_1 \sin\alpha}{g}} = 2\sqrt{H_1 H_2}\sin\alpha$

(27) **Answer :** (4)
Solution:
Pressure at a depth, $x = P_0 + \rho gx$
Force on a very small section = $(P_0 + \rho gx)\,(2R)dx$
$\Rightarrow dF = P_0 \times 2R \times dx + 2R\rho gxdx$

$$\Rightarrow\ F = \int dF = \int_0^h 2P_0 Rdx + \int_0^h 2R\rho gxdx$$

$$\Rightarrow\ F = 2P_0 Rh + \frac{2R\rho gh^2}{2}$$
$\Rightarrow F = 2P_0Rh + \rho gRh^2$

(28) **Answer :** (1)
Solution:
$\alpha = \sigma eA(500^4 - 300^4)$
$\beta = \sigma A(500^4 - 300^4)$
$\Rightarrow\ e = \frac{\alpha}{\beta}$

(29) **Answer :** (4)
Solution:
$v = \sqrt{2gh} = \sqrt{2\times 10\times 20} = 20\ \text{m/s}$
Retardation experienced by ball = $\frac{F_B - Weight}{Mass}$
$= \frac{3\rho\times v\times g - \rho gv}{\rho v} = 2g = 20\ \text{m/s}^2$
$S = ut + \frac{1}{2}at^2$
$0 = 20t - \frac{1}{2}\times 20\times t^2$
$0 = 20t\left(1 - \frac{t}{2}\right)$
$\Rightarrow t = 2$ sec

(30) **Answer :** (4)
Solution:
$\because R_s = R_1 + R_2$
$\frac{3L}{K_s A} = \frac{L}{KA} + \frac{2L}{2KA} = \frac{2L}{KA}$
$K_s = \frac{3}{2}K$

(31) **Answer :** (1)
Solution:
$\rho_M \times v_M \times g = \rho_L \times v_s \times g\ \Rightarrow\ \frac{v_S}{V_M} = F = \frac{\rho_M}{\rho_L}$
As temperature of the system is increased by ΔT
$\Rightarrow\ \rho'_L = \frac{\rho_L}{1+\gamma_2\Delta T}$
$\rho'_M = \frac{\rho_M}{1+\gamma_1\Delta T}$

New fraction submerged

$\Rightarrow \quad F' = \frac{\rho'_M}{\rho'_L} = \frac{\frac{\rho_M}{1+\gamma_1 \Delta T}}{\frac{\rho_L}{1+\gamma_2 \Delta T}}$

$\Rightarrow \quad F' = \frac{1+\gamma_2 \Delta T}{1+\gamma_1 \Delta T} \times \frac{\rho_M}{\rho_L}$

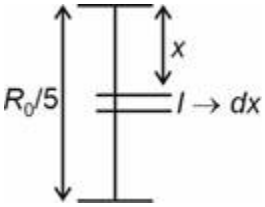
$\Rightarrow \quad F' = F\left(\frac{1+\gamma_2 \Delta T}{1+\gamma_1 \Delta T}\right)$

(32) **Answer :** (4)
Solution:
When it is rotating with maximum angular velocity,
$T \times \sin\theta = m\omega^2 l \sin\theta \quad \Rightarrow \quad T = m\omega^2 l$
$\Rightarrow \quad T = 200 \times \frac{19}{25} \times 20$

$\Delta l = \frac{Fl}{Ay} = \frac{200 \times \frac{19}{25} \times 20 \times 20}{8 \times 10^{-4} \times 2 \times 10^{11}} = 0.38 \text{ mm}$

(33) **Answer :** (2)
Solution:
Applying energy conservation,
$U_i + K_i = U_F + K_F$
$\Rightarrow \quad -\frac{GMm}{L} \times 2 + \frac{1}{2} m V_e^2 = 0 + 0 \quad \Rightarrow \quad V_e = 2\sqrt{\frac{GM}{L}}$

(34) **Answer :** (1)
Solution:
Variation of acceleration due to gravity with depth,



$dM = \lambda dx$, weight = $\lambda dx \times g\left[1 - \frac{x}{R}\right]$

$dw = \lambda g dx\left[1 - \frac{x}{R}\right] \quad \Rightarrow \quad dw = \lambda g\left[dx - \frac{x dx}{R}\right]$

$w = \lambda g\left[\frac{R}{5} - \frac{R_0^2}{2 \times 25 \times R}\right]_0^{R/5} \quad \Rightarrow \quad w = \lambda g\left[\frac{R}{5} - \frac{R}{50}\right]$

$w = \lambda g R\left[\frac{9}{50}\right] \quad \Rightarrow \quad w = \frac{9\lambda}{50} gR$

$\Rightarrow \quad w = \frac{9\lambda g R}{50}$

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

$P_0 + \rho g H - \rho a H = \frac{P_0}{3}$

$\Rightarrow \quad \frac{2P_0}{3} = \rho \times H\left(a - g\right) \quad \Rightarrow \quad a = \frac{2P_0}{3\rho H} + g$

(36) **Answer :** (3)
Solution:
W = $2T \times S(\Delta A)$

$W = 2 \times T \times \left[\frac{4\pi \times 4D^2}{4} - \frac{4\pi D^2}{4}\right]$

$W = 2T \times \frac{4\pi D^2}{4}\left[4 - 1\right] \quad \Rightarrow \quad W = 6\pi D^2 T$

(37) **Answer :** (2)
Solution:

$\beta = \frac{K \times A \times \Delta T}{\Delta x}$, if all the linear dimensions are doubled

$\Rightarrow \quad A' = 4A, \ \Delta x' = 2\Delta x$

$\Rightarrow \quad \beta' = 2\beta$

(38) **Answer :** (1)
Solution:
The total mechanical energy of a planet around sun remain constant. The air will flow from tube from smaller radius to larger radius bubble because pressure inside small radius bubble is more.

(39) **Answer :** (4)
Solution:
If the length of steel rod increases by 0.2%, then increase in volume will be 0.6% as coefficient of volume expansion will be thrice of linear expansion.
If measurement is taken at higher temperature, then scale reading will be lesser than true value.

(40) **Answer :** (3)
Solution:
Breaking stress remains constant
$\Rightarrow \ \frac{500}{1\times1} = \frac{F}{9} \ \Rightarrow \ F = 4500 \text{ N}$

(41) **Answer :** (2)
Solution:
When capillary tube is tilted through an angle θ, then length of water risen in capillary, $l = \frac{h}{\cos\theta}$
Here, θ = 30°
$\therefore \ l = \frac{5}{\cos 30^\circ} = \frac{10}{\sqrt{3}} \text{cm}$

(42) **Answer :** (3)
Solution:
Energy stored per unit volume $= \frac{1}{2} \times Y \times (\text{Strain})^2$
$= \frac{1}{2} \times 1.1 \times 10^{11} \times (1 \times 10^{-3})^2$
$= 0.5 \times 1.1 \times 10^{11} \times 10^{-6}$
$= 5.5 \times 10^4 \text{ Jm}^{-3}$

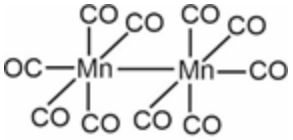
(43) **Answer :** (3)
Solution:
$B = -\frac{\Delta P}{\frac{\Delta v}{v}}, \ \Delta v = 0 \ \Rightarrow \ B \to \infty$

(44) **Answer :** (4)
Solution:
$F = \frac{9}{5}C + 32 \ \Rightarrow \ \Delta F = \frac{9}{5}\Delta C \ \Rightarrow \ \Delta F = \frac{9}{5} \times 30 = 54^\circ$

(45) **Answer :** (2)
Solution:
$\frac{T_1}{T_2} = \frac{\lambda_{m_2}}{\lambda_{m_1}} = \frac{4200}{140} = \frac{30}{1}$

CHEMISTRY

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



$[Mn_2(CO)_{10}]$

(47) **Answer :** (2)
Hint:
Spin magnetic moment $\mu = \sqrt{n(n+2)}$
BM where n is the number of unpaired electrons.
Solution:

Ions	Number of unpaired electrons (n)	Magnetic moment

Mn^{2+}	5	5.92
Cr^{3+}	3	3.87
Fe^{2+}	4	4.90
Ni^{2+}	2	2.84

(48) **Answer :** (4)
Solution:

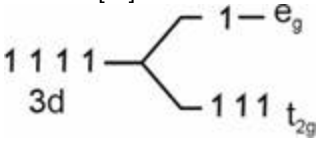
Element	2^{nd} ionisation enthalpy/kJ mol^{-1}
Fe	1561
Co	1644
Ni	1752
Cu	1958

(49) **Answer :** (3)
Solution:
Polonium show +2 and +4 oxidation states.

Element	Boiling point/K
Te	1260
Po	1235

(50) **Answer :** (3)
Hint:
In metal carbonyls, M → ligand back bonding increases, C – O bond order decreases thus C – O bond length increases.
Solution:
The correct decreasing order of C – O bond length is
$[Ti(CO)_4]^{2-} > [V(CO)_6]^{-} > [Cr(CO)_6] > [Mn(CO)_6]^{+}$

(51) **Answer :** (1)
Hint:
In $[Mn(Cl)_6]^{3-}$
$Mn^{3+} \Rightarrow [Ar]4s^0 3d^4$



Crystal field stabilization energy (CFSE)
$= -0.4\ \Delta_0 \times 3 + 0.6\ \Delta_0 \times 1 = -0.6\ \Delta_0$

(52) **Answer :** (2)
Solution:
Boiling point of inert gases increases with increase in molar mass.

(53) **Answer :** (3)
Solution:

$$[Cr(NH_3)_6]Cl_3 \xrightarrow{\text{In solution}} [Cr(NH_3)_6]^{3+} + 3Cl^-$$

So, 3 moles of AgCl will be precipitated.

(54) **Answer :** (1)
Solution:

Boiling point/K	Hydrides
238.5	NH_3
185.5	PH_3

(55) **Answer :** (2)
Solution:
$[Cr(NH_3)_3Cl_3]$ forms fac-and mer-isomers

(56) **Answer :** (1)
Solution:
NO_2^- is an ambidentate ligand, so can show linkage isomerism.

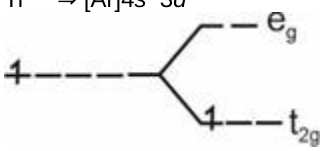
(57) **Answer :** (3)
Solution:

$[Ni(CN)_4]^{2-}$	dsp^2, diamagnetic
$[Cr(NH_3)_6]^{3+}$	d^2sp^3, paramagnetic
$[Co(H_2O)_6]^{3+}$	d^2sp^3, diamagnetic
$[Ni(CO)_4]$	sp^3, diamagnetic

(58) **Answer :** (4)
Solution:
Electronic configuration of Gd = $[Xe]4f^75d^16s^2$
Electronic configuration of Lu = $[Xe]4f^{14}5d^16s^2$

(59) **Answer :** (3)
Solution:
In the formation of $[Co(NH_3)_6]^{3+}$, the inner *d* orbital is used in hybridisation so it is inner orbital complex.

(60) **Answer :** (1)
Solution:
$[Ti(H_2O)_6]^{3+}$
$Ti^{3+} \Rightarrow [Ar]4s^03d^1$



It is violet in colour due to t_{2g} to e_g e^- transition.

(61) **Answer :** (1)
Solution:
NO_2^- and SCN^- are ambidentate ligand.

(62) **Answer :** (1)
Solution:
Small size as well as the less inter electronic repulsion leads to highest bond dissociation enthalpy of Cl_2. F_2 has small size but high inter electronic repulsion so its bond dissociation enthalpy is less as compared to Cl_2 and Br_2.

Molecule	$\Delta_{diss}H°$ (kJ mol^{-1})
F_2	158.8
Cl_2	242.6
Br_2	192.8
I_2	151.1

(63) **Answer :** (1)
Solution:
XeF_4 is square planar and non-polar molecule.
$6XeF_4 + 12H_2O \rightarrow 4Xe + 2XeO_3 + 24HF + 3O_2$

(64) **Answer :** (4)
Solution:
XeF_6 on complete hydrolysis give XeO_3 while on partial hydrolysis Gives $XeOF_4$ and XeO_2F_2
$XeF_6 + 3\ H_2O \rightarrow XeO_3 + 6\ HF$

(65) **Answer :** (1)
Solution:

Cl_2 + 2NaOH $\rightarrow$NaCl + NaOCl + H_2O

(66) **Answer :** (4)
Solution:
$\mathrm{IF_7 + 4H_2O \rightarrow HIO_4 + 7\,HF}$

(67) **Answer :** (1)
Solution:
Due to lanthanoid contraction ionic radii from lanthanum to lutetium decreases and Zr and Hf have almost identical radii.

(68) **Answer :** (3)
Hint:
Curium is an actinoid.
Solution:
The correct electronic configuration of curium is [Rn]$5f^7 6d^1 7s^2$

(69) **Answer :** (4)
Solution:
Compound TiO is used pigment industry and MnO_2 for use in dry battery cells.

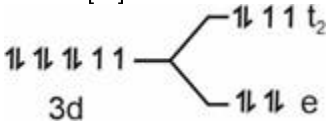
(70) **Answer :** (4)
Solution:
In mischmetall, approximate percentage of lanthanoid metal is 95% and iron 5%.

(71) **Answer :** (3)
Solution:
• Nitrogen does not have vacant d orbital so it cannot form dπ-dπ bond.
• Single N–N bond is weaker than the single P–P bond due to high interelectronic repulsion of the non-bonding electrons, owing to the small bond length.

(72) **Answer :** (2)
Solution:
Down the group effective nuclear charge increases in the metal ion hence spliting energy (Δ_0) increases.

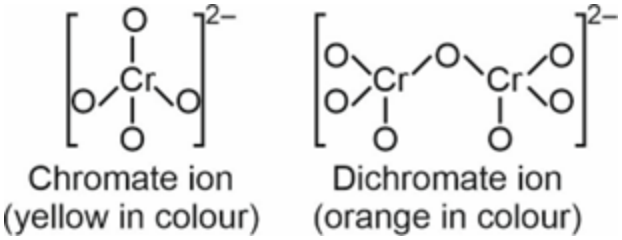
(73) **Answer :** (1)
Solution:
$4HNO_3 + P_4O_{10} \rightarrow 4HPO_3 + 2N_2O_5$
$4Zn + 4HNO_3$ (conc.) $\rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2$
Phosphonium ion has regular tetrahedral geometry with only weaker bond pair-bond pair repulsions resulting in larger bond angle.

(74) **Answer :** (4)
Solution:
In $[NiCl_4]^{2-}$
$Ni^{2+} \Rightarrow [Ar]4s^0 3d^8$



(75) **Answer :** (2)
Solution:
Haber's process → $\mathrm{N_2\left(g\right) + 3H_2 \overset{Fe}{\rightleftharpoons} 2\,NH_3\left(g\right)}$
Deacon's process → $\mathrm{4HCl + O_2 \xrightarrow{CuCl_2} 2\,Cl_2 + 2H_2O}$
Ziegler catalyst → $TiCl_4$ + $Al(CH_3)_3$

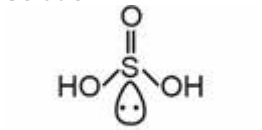
(76) **Answer :** (3)
Solution:



Chromate ion (yellow in colour) Dichromate ion (orange in colour)

(77) **Answer :** (3)
Solution:
Rhombic sulphur is insoluble in water but soluble is CS_2.
- $3O_2(g) \rightarrow 2O_3(g) H^{\ominus}(298\ K) = +142\ kJ/mol$
- $SO_2(g) + Cl_2(g) \rightarrow SO_2Cl_2(l)$

(78) **Answer :** (1)
Solution:



(H_2SO_3) sulphurous acid

(79) **Answer :** (1)
Solution:

Ion	Spin only magnetic moment
V^{2+}	3.87 BM
Cr^{2+}	4.90 BM
Fe^{2+}	4.90 BM

(80) **Answer :** (3)
Solution:
- Sc^{3+} ⇒ $[Ar]4s^0 3d^0$; It does not have any d electron
  Zn^{2+} ⇒ $[Ar]4s^0 3d^{10}$; It is colourless due to absence of unpaired electron(s)
- Correct oxidising power is $MnO_4^- > Cr_2O_7^{2-}$

Correct basic strength is $V_2O_3 > V_2O_4 > V_2O_5$

(81) **Answer :** (3)
Solution:
- Form $La(OH)_3$ to $Lu(OH)_3$; basicity decreases because ionic size from La^{3+} to Lu^{3+} decreases.
- Thorium exhibit only +4 oxidation state.

(82) **Answer :** (1)
Solution:
- Cerium (Ce) exhibits +2, +3 and +4 oxidation states while Eu and Yb exhibit +2 and +3 oxidation states.

(83) **Answer :** (3)
Solution:
Primary valency = Oxidation state of central metal atom/ion
Oxidation state of Fe = +2
Secondary valency = Coordination number of metal/metal ion
coordination number of Fe(+2) = 6

(84) **Answer :** (4)
Solution:

Element	E° value (M^{2+}/M)
Co	–0.28 V
Ni	–0.25 V
Cu	+0.34 V

Zn	–0.76 V

(85) **Answer :** (3)
Solution:
$10I^- + 2\,MnO_4^- + 16H^+ \rightarrow 2\,Mn^{2+} + 8H_2O + 5I_2$
For 10 mol I^- → 2 mol $2MnO_4^-$ required
For 2 mol I^- → $\frac{2}{10} \times 2 = \frac{2}{5}$ mol MnO_4^- required

(86) **Answer :** (3)
Solution:
Cr^{2+} is a stronger reducing agent than Fe^{2+} ion in water as Cr^{2+} easily gets oxidised to Cr^{3+} (d^3 configuration) as compared to Fe^{2+} oxidising to Fe^{3+}.
Scandium show only +3 oxidation state

(87) **Answer :** (1)
Solution:
In 3*d* series elements, Ni and Cu has highest density (8.9 g cm^{-3})

(88) **Answer :** (4)
Solution:

Hydrides	Boiling point/K
H_2O	373
H_2S	213
H_2Se	232
H_2Te	269

(89) **Answer :** (3)
Solution:
In $[PtCl_4]^{2-}$, the hybridisation of Pt is dsp^2 and shape of the complex is square planar.

(90) **Answer :** (2)
Solution:
The correct field strength is
$F^- < OH^- < C_2O_4^{2-} < H_2O$

BOTANY

(91) **Answer :** (3)
Solution:
• Number of sugar and phosphate is equal.
• Each base pair contain double number of sugar and phosphate that will be = 2 × 2.4 × 10^6 = 4.8 × 10^6
• Each nucleosome contain about 200 base pairs, so the number of nucleosome will be $\frac{2.4\times10^6}{200} = 1.2 \times 10^{-2} \times 10^6$
= 1.2 × 10^4 = 12 × 10^3

(92) **Answer :** (4)
Hint:
A gene which codes for a polypeptide has both exons and introns in eukaryotes.
Solution:
Mature mRNA has exons only, not introns.

(93) **Answer :** (3)
Solution:
snRNAs are transcribed by RNA polymerase-III and help in processing of RNA.

(94) **Answer :** (3)
Solution:
Discontinuously synthesized DNA fragments are joined by DNA ligase enzyme.

(95) **Answer :** (2)
Solution:
UTRs are not translated and are referred as untranslated regions (UTR).

(96) **Answer :** (3)
Solution:
DNA with more G ≡ C than A = T requires high energy to separate the strands.

(97) **Answer :** (1)
Hint:
The *lac y* gene codes for permease.
Solution:
Permease increases permeability of the cell to β-galactosidase. As the *y* gene becomes non-functional, permease will not form that will lead to prohibition of the entry of lactose into the cell which eventually shuts down the *lac* operon. Formation of transacetylase would not be affected.

(98) **Answer :** (1)
Solution:
VNTRs belong to a class of satellite DNA referred to as minisatellites. The copy number varies from chromosome to chromosome in an individual.

(99) **Answer :** (4)
Solution:
Initiation step of transcription is catalysed by sigma factor.
During initiation stage of transcription, sigma (σ) factor or initiation factor binds to the promoter site of DNA and confers specificity.

(100) **Answer :** (3)
Solution:
During transcription, one strand of DNA acts as template.
Single RNA transcript is produced after transcription.
During transcription, genetic information gets copied from one strand of DNA into RNA.

(101) **Answer :** (1)
Hint:
Deletion of a nucleotide at any position results in frameshift mutation that causes change in the codons after the site of mutation.
Solution:
Deletion at 271 position, will not alter 270 bases which are present prior to the site of deletion. So, 90 codons will remain unaltered.

(102) **Answer :** (4)
Hint:
Colour blindness is a recessive X-linked character. For a son being colourblind, his mother should be carrier or colour blind.
Solution:
Since one son is normal and one is colourblind, it indicates that the mother is carrier for this character. In this case, the probability of each son for being colourblind would be 50%.

(103) **Answer :** (2)
Hint:
Heterozygous tall pea plant with round seed shape will have genotype TtRr
Solution:

Parents : TtRr (tall with round seed) × ttrr (dwarf with wrinkled seed)

Gametes : TR, Tr, tR, tr tr

F_1 gen:

	TR	**Tr**	**tR**	**tr**
tr	TtRr Tall with round seed	Ttrr Tall with wrinkled seed	ttRr dwarf with Round seed	ttrr dwarf with wrinkled seed

(104) **Answer :** (2)
Solution:
PpQqRr – In this case, if any 2 genes are completely linked – let us say, P and Q genes are completely linked,

Pp Qq Rr

This is treated as one heterozygote

∴Type of gametes = $2^n = 2^2$ = 4 types of gametes.

(105) Answer : (3)

Solution:

When the modified allele produces a non-functional enzyme, offspring shows the phenotype of only one of the parents when two varieties of species of plant homozygous for a particular trait are crossed.

(106) Answer : (2)

Solution:

Since, probability of inflated pod = $\frac{3}{4}$; and probability of white coloured flower = $\frac{1}{4}$

$\Rightarrow \frac{3}{4} \times \frac{1}{4} \times 512 \Rightarrow 96$

(107) Answer : (1)

Hint:

Replication does not initiate randomly at any place in DNA. It starts at origin of replication.

Solution:

It is because of the requirement of the origin of replication that a piece of DNA if needed to be propagated during recombinant DNA procedures, requires a vector. The vectors provide the origin of replication.

(108) Answer : (1)

Solution:

AABBCC = 80 g

aabbcc = 20 g

∴ Contribution of each dominant allele =

$\frac{60}{6} = 10$ g

AaBbCc = (3 × 10) + 20 = 50 g

AaBBCc = (4 × 10) + 20 = 60 g

aaBbCC = (3 × 10) + 20 = 50 g

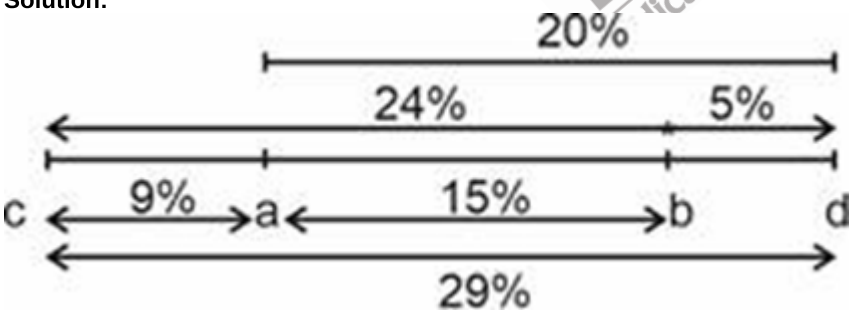
Aabbcc = (1 × 10) + 20 = 30 g

(109) Answer : (3)

Hint:

1% recombination frequency = 1 cM or map unit.

Solution:



(110) Answer : (3)

Hint:

Gene for cystic fibrosis is found on autosome.

Solution:

Cystic fibrosis is an autosomal recessive disorder.

(111) Answer : (3)

Solution:

9 : 3 : 3 : 1 phenotypic ratio is possible if the genes show independent assortment in a dihybrid cross.

The ratio deviates in case of linkage.

(112) Answer : (1)

Solution:

In pedigree chart, consanguineous mating is represented by the above symbol.

(113) Answer : (2)
Solution:

E. coli [4.6×10^6 bp] → No post transcriptional modifications.
Male honey bees → Haplo-diploid sex determination.
Saccharomyces cerevisiae → Its genome was sequenced during HGP

(114) Answer : (3)
Solution:

- *Pisum sativum* – Traits for seed shape and its colour are on different chromosome
- T_2 bacteriophage – DNA is genetic material, in which thymine is found
- Dog flower – Incomplete dominance
- QB bacteriophage – RNA is genetic material

(115) Answer : (4)
Solution:
Since, transcription and translation are energetically expensive processes, these have to be tightly regulated, RNA was the first genetic material. For long DNA molecules, since two strands of DNA cannot be separated in its entire length due to very high energy requirement.

(116) Answer : (2)
Solution:
Edward's syndrome is a chromosomal disorder. The pedigree can be true for both autosomal recessive trait and sex-linked recessive trait.

(117) Answer : (3)
Solution:
Due to transversion mutation, the gene having GAG is converted to GUG, so there is a substitution of glutamic acid by valine at sixth position of β-globin chain.

(118) Answer : (3)
Solution:
First identification of nuclein by Friedrich Meischer occured in 1869. Watson received his PhD in 1950. On a study of effect of hard x-rays on bacteriophage. T.H. Morgan obtained 98.7% parental types and 1.3% recombinant types in F2 generation when the cross was conducted between yellow-bodied and white-eyed female with brown-bodied and red-eyed male.

(119) Answer : (4)
Solution:

(i) $I^AI^A \times ii$ or $I^Ai \times ii$
↓ ↓
A A, O

(ii) $I^AI^B \times ii$
↓
A, B

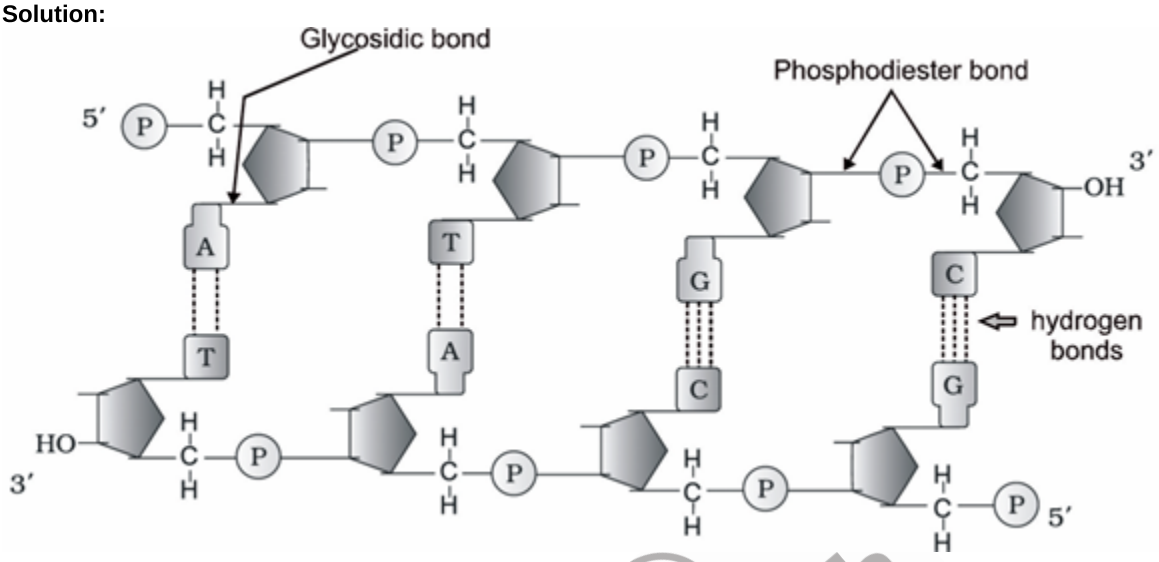
(iii)
- $I^AI^A \times I^BI^B$
↓
AB
- $I^AI^A \times I^Bi$
↓
A, AB
- $I^Ai \times I^BI^B$
↓
AB, B
- $I^Ai \times I^Bi$
↓
AB, A, B, O

(120) Answer : (3)

Solution:
UUU codes for phenylalanine in all organisms. AUG codes for methionine. UGG codes for tryptophan. *i* gene codes for repressor protein and *y* gene codes for permease.

(121) Answer : (4)
Solution:
The given karyotype is showing Down's syndrome in which trisomy of chromosome 21 occurs. It was first described by Langdon down in 1866.

(122) Answer : (4)
Solution:



(123) Answer : (3)
Solution:

Isolation of DNA
↓
Digestion by restriction endonuclease
↓
Separation of DNA fragments by electrophoresis
↓
Southern blotting
↓
Hybridisation with VNTR probe
↓
Autoradiography

(124) Answer : (3)
Solution:
A → *Caenorhabditis elegans*
B → VNTRs
C → Character
D → Allele
E → Introns

(125) Answer : (3)
Solution:
Repressor binds to the operator gene, which controls the activity of it.

(126) Answer : (2)
Solution:
BAC stands for Bacterial Artificial Chromosome.

(127) Answer : (1)
Solution:
The ribosomes are made up of ribonucleic acids and proteins.

(128) Answer : (2)
Solution:
Marshall Nirenberg's cell-free system for protein synthesis finally helped the genetic code to be deciphered.

(129) Answer : (4)
Solution:
Genetic material should provide the scope for slow mutation that are required for evolution.

(130) Answer : (3)
Solution:
S strain (heat-killed) + R strain (live) → Inject into mice → Mice die

(131) Answer : (2)
Solution:
Palm crease is observed in Down's syndrome inflicted invididuals.

(132) Answer : (3)
Solution:
Infection, blending and centrifugation are the steps in Hershey Chase experiment.

(133) Answer : (3)
Solution:
Phenylketonuria is an inborn error of metabolism. It is inherited as the autosomal recessive trait. The affected individual lacks a liver enzyme called phenylalanine hydroxylase.

(134) Answer : (4)
Solution:
Morgan coined the terms ‘linkage’ and 'recombination'.

(135) Answer : (2)
Solution:
Polyploidy is often seen in plants.

ZOOLOGY

(136) Answer : (1)
Solution:
Prothrombin is an inactive plasma protein which helps in clotting of blood.

Prothrombin $\xrightarrow[Ca^{2+}]{\text{Thrombokinase}}$ Thrombin

(137) Answer : (2)
Solution:
Functional Residual Capacity (FRC) is stated as the volume of air that will remain in the lungs after a normal expiration. This includes ERV+RV.

(138) Answer : (4)
Solution:
The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas the second heart sound (dub) is associated with the closure of the semilunar valves. These sounds are of clinical diagnostic significance.

(139) Answer : (4)
Solution:

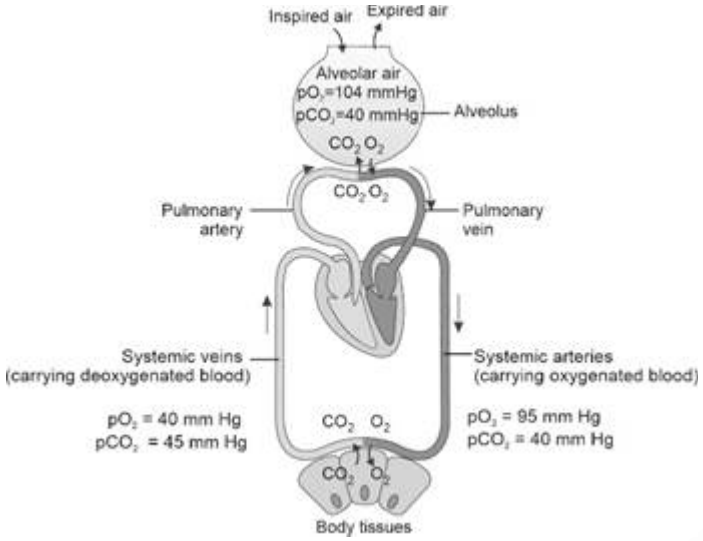
Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

(140) Answer : (1)
Solution:
Aquatic arthropods respire through gills.

(141) Answer : (1)
Hint:
Equal to the number of primary bronchi.

Solution:
The diffusion membrane is made up of three major layers namely, the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries, and the basement substance in between them.
The basement substance is the acellular layer.

(142) Answer : (2)
Hint:
Pulmonary veins carry oxygenated blood.
Solution:



(143) Answer : (1)
Hint:
Trachea extends upto mid thoracic cavity.
Solution:

Trachea divides into right and left primary bronchi at the level of 5^{th} thoracic vertebra. Each bronchi undergoes repeated divisions to form secondary and tertiary bronchi and bronchioles.

(144) Answer : (3)
Hint:
Composition of plasma
Solution:
Lymph has the same mineral distribution as that in plasma. Exchange of nutrients, gases, *etc.,* between blood and the cells always occur through this fluid. Lymph is a colourless fluid containing specialised lymphocytes which are responsible for immune responses of the body. Lymph is also an important carrier for nutrients, hormones, *etc*. Fats are absorbed through lymph in the lacteals present in the intestinal villi.

(145) Answer : (3)
Solution:
Heart is mesodermal in origin .

(146) Answer : (3)
Solution:
Spleen is also called ‘graveyard of RBCs’.

(147) Answer : (1)
Hint:
Pulmonary circulation
Solution:
Pulmonary artery carries deoxygenated blood from right ventricle of the heart to the lungs.

(148) Answer : (4)
Solution:
Heart beats 72 times per minute, *i.e.,* 72 cardiac cycles are performed per minute.

(149) Answer : (2)
Solution:
Blood moves out of the ventricles into the respective vessels during ventricular systole and atrio-ventricular valves close during ventricular systole.

(150) Answer : (3)
Solution:
Fishes have 2-chambered heart with an atrium and a ventricle. Amphibians and reptiles (except crocodile) have 3-chambered heart with 2 atria and a single ventricle, whereas, birds and mammals possess 4-chambered heart with two atria and two ventricles.

(151) Answer : (4)
Solution:
Percentage of proteins in plasma is 6-8% and that of monocytes among total WBCs is also 6-8%.
• *Pheretima* (Earthworm), *Hyla* (tree frog) possess closed circulatory system.
• Systemic circulation in *Struthio* (ostrich) starts from left ventricle and ends in right atrium.

(152) Answer : (4)
Solution:
The SAN can generate the maximum number of action potentials, *i.e.*, 70-75 beats/min and is responsible for initiating and maintaining the rhythmic contractility of heart.

(153) Answer : (1)
Solution:
Some of the air a person breathes never reaches the areas performing gaseous exchange but simply fills respiratory passages, such as the nose, pharynx and trachea, where gas exchange does not occur. This air is called dead space air because it is not useful for gas exchange.

(154) Answer : (3)
Solution:
When there is a blockage of an airway, there is no movement of fresh air. Therefore, the air in the alveoli reaches an equilibrium with pulmonary arterial blood. Therefore, pO_2 will decrease from 100 to 40 mm Hg, pCO_2 will increase from 40 to 45 mm Hg and systemic pO_2 will decrease, because there is decrease in oxygen uptake from the alveoli, thus decreased O_2 diffusion from alveoli will occur.

(155) Answer : (4)
Solution:
• Movement of the diaphragm mainly accounts for the change in intrathoracic volume during quiet inspiration.
• In cockroaches, respiration takes place through tracheal tubes.
• During swallowing, glottis is covered by epiglottis.

(156) Answer : (3)
Solution:
(R) is vital capacity
(Q) is tidal volume
(P) is residual volume
Residual volume prevents the lungs from collapsing by keeping the alveoli open.

(157) Answer : (3)
Solution:
Intra-pleural pressure during inhalation is always less than the atmospheric pressure.

(158) Answer : (2)
Solution:
Exhaled CO_2 is never removed when an individual breaths through air tight bag and it continues to accumulate in the bag. This increases the pCO_2 that acts as the stimulus for increased breathing.

(159) Answer : (1)
Solution:
Hypoxia is a condition where the body or a region of the body is deprived of adequate oxygen at the tissue level.

(160) Answer : (2)
Solution:
We cannot directly alter the pulmonary volume.

(161) Answer : (2)
Solution:
A chemosensitive area is situated adjacent to the rhythm centre to make necessory adjustments in the respiratory process by which these substances can be eliminated.

(162) Answer : (3)
Solution:
Vital capacity generally decreases during an asthma attack and is often reduced even between attacks, especially in adults, due to airway inflammation.

(163) Answer : (1)
Solution:
Alveolar ventilation = (Tidal volume – Dead space) × R.R
= 500 – 150 = 350 mL
= 350 × 12 = 4200 mL/min

(164) Answer : (2)
Solution:
When heart rate increases, the duration of each cardiac cycle decreases, including the contraction and relaxation phases. The duration of the action potential and systole also decreases, but not by great percentage as diastole.

(165) Answer : (1)
Solution:
Myocardium has its own network of blood vessels, the coronary circulation. The coronary arteries branch from the ascending aorta and encircle the heart to supply blood to myocardium.

(166) Answer : (3)
Solution:
After ventricular ejection, both the aortic valve and the pulmonary valve close; this is followed by the period of isovolumetric relaxation.

(167) Answer : (3)
Solution:
Basophils < Monocytes < Neutrophils < Thrombocytes < Erythrocytes

(168) Answer : (4)
Solution:
After a meal, blood in hepatic portal vein is rich in nutrients which are received from the digestive system.

(169) Answer : (4)
Solution:
Basophils secrete histamine, serotonin, heparin, *etc*., and are involved in inflammatory reactions.
Basophils are the least (0.5 – 1 per cent) among total WBCs.

(170) Answer : (2)
Solution:

Blood group	Antigens on RBCs	Antibodies in Plasma	Donor's Group
A	A	Anti-B	A, O
B	B	Anti-A	B, O
AB	A, B	Nil	AB, A, B, O
O	Nil	Anti-A, B	O

(171) Answer : (1)
Solution:
During the pandemic, plasma was collected from individuals who recovered from COVID-19 and had AB^{+} blood group to use their antibodies to treat patients because no anti-A or anti-B antibodies are found in AB^{+ve} individuals . This plasma can be given to patients of any blood type without causing adverse immune reactions.

(172) Answer : (1)
Solution:
Chordae tendinae are tough fibrous cords that anchor atrio-ventricular valves to papillary muscles in the ventricles. They prevent regurgitation.

(173) Answer : (1)
Solution:
Hypertension is the term for blood pressure that is higher than normal (120/80 mm Hg). In this measurement 120 mm Hg (millimetres of mercury pressure) is the systolic, or pumping, pressure and 80 mm Hg is the diastolic, or resting, pressure. If repeated checks of blood pressure of an individual is 140/90 mm Hg or higher, it shows hypertension. High blood pressure leads to heart diseases and also affects vital organs like brain and kidney.

(174) Answer : (1)
Solution:
Simple organisms like sponges and coelenterates circulate water from their surroundings through their body cavities to facilitate the cells to exchange these substances. More complex organisms use special fluids within their bodies to transport such materials.

(175) Answer : (3)
Solution:

Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body. It is sometimes called congestive heart failure because congestion of the lungs is one of the main symptoms of this disease. Heart failure is not the same as cardiac arrest (when the heart stops beating) or a heart attack (when the heart muscle is suddenly damaged by an inadequate blood supply).

(176) Answer : (2)

Solution:

During a cardiac cycle, each ventricle pumps out approximately 70 mL of blood which is called the stroke volume. The stroke volume multiplied by the heart rate (no. of beats per min.) gives the cardiac output. Therefore, the cardiac output can be defined as the volume of blood pumped out by each ventricle per minute and averages 5000 mL or 5 litres in a healthy individual. During high heart rates, diastole becomes too short for adequate ventricular filling.

(177) Answer : (3)

Hint:

A flat bone

Solution:

The lungs are situated in the thoracic chamber which is anatomically an air-tight chamber. The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by the dome-shaped diaphragm.

(178) Answer : (3)

Solution:

Volume of thoracic chamber increases in the dorso-ventral axis when external inter-costal muscles contract during inspiration.

(179) Answer : (4)

Solution:

Human skin is dry (does not allow exchange of gases). It is not thin (gases can pass through thin membrane) and it is impermeable to O_2 and CO_2.

(180) Answer : (1)

Hint:

Lower most part of the brain stem.

Solution:

A specialised centre present in the medulla region of the brain called respiratory rhythm centre is primarily responsible for the regulation of respiration.

A chemosensitive area is situated adjacent to the respiratory rhythm centre, which is highly sensitive to pCO_2 and concentration of hydrogen ions.