CHERRYTOP LEARNING

Bangalore

KCET MOCK TEST PAPER-3 (KEY)

Physics

1) **1**	2) **1**	3) **3**	4) **3**	5) **3**	6) **1**	7) **2**	8) **3**	9) **2**	10) **1**
11) **1**	12) **4**	13) **3**	14) **1**	15) **2**	16) **1**	17) **3**	18) **4**	19) **1**	20) **3**
21) **4**	22) **3**	23) **4**	24) **4**	25) **2**	26) **3**	27) **3**	28) **4**	29) **3**	30) **2**
31) **4**	32) **3**	33) **2**	34) **2**	35) **2**	36) **2**	37) **4**	38) **3**	39) **3**	40) **4**
41) **2**	42) **2**	43) **4**	44) **2**	45) **2**	46) **3**	47) **4**	48) **3**	49) **4**	50) **1**
51) **4**	52) **1**	53) **2**	54) **3**	55) **4**	56) **2**	57) **4**	58) **4**	59) **4**	60) **4**

Chemistry

61) **2**	62) **4**	63) **1**	64) **3**	65) **1**	66) **4**	67) **1**	68) **1**	69) **3**	70) **1**
71) **1**	72) **3**	73) **1**	74) **1**	75) **3**	76) **1**	77) **4**	78) **2**	79) **2**	80) **3**
81) **3**	82) **3**	83) **2**	84) **1**	85) **3**	86) **2**	87) **3**	88) **1**	89) 1	90) **4**
91) **4**	92) **4**	93) **4**	94) **2**	95) **4**	96) **2**	97) **4**	98) **2**	99) **2**	100) **2**
101) **2**	102) **4**	103) **3**	104) **1**	105) **3**	106) **1**	107) **2**	108) **2**	109) **4**	110) **4**
111) **1**	112) **1**	113) **1**	114) **1**	115) **4**	116) **1**	117) **3**	118) **2**	119) 1	120) **2**

Mathematics

121) **4**	122) **2**	123) **3**	124) **4**	125) **3**	126) **1**	127) 1	128) **3**	129) **1**	130) **2**
131) **4**	132) **2**	133) **4**	134) **4**	135) **3**	136) **3**	137) **4**	138) **None**	139) **2**	140) **3**
141) **1**	142) **2**	143) **3**	144) **1**	145) **2**	146) **4**	147) **1**	148) **4**	149) **3**	150) **2**
151) **2**	152) **4**	153) **2**	154) **1**	155) **4**	156) **3**	157) **3**	158) **3**	159) **1**	160) **2**
161) **3**	162) **1**	163) **2**	164) **4**	165) **3**	166) **4**	167) **4**	168) **1**	169) **3**	170) **4**
171) **2**	172) **1**	173) **3**	174) **4**	175) **4**	176) **2**	177) **1**	178) **2**	179) **3**	180) **1**

Biology

181) **4**	182) **1**	183) **3**	184) **1**	185) **4**	186) **3**	187) **4**	188) **4**	189) **4**	190) **3**
191) **1**	192) **4**	193) **1**	194) **1**	195) **4**	196) **3**	197) **2**	198) **2**	199) **2**	200) **3**
201) **2**	202) **4**	203) **1**	204) **3**	205) **4**	206) **3**	207) **2**	208) **3**	209) **3**	210) **4**
211) **1**	212) **4**	213) **4**	214) **4**	215) **3**	216) **4**	217) **2**	218) **3**	219) **2**	220) **4**
221) **2**	222) **2**	223) **2**	224) **4**	225) **4**	226) **2**	227) **2**	228) **2**	229) **2**	230) **2**
231) **3**	232) **2**	233) **2**	234) **3**	235) **1**	236) **4**	237) **3**	238) **3**	239) **2**	240) **3**

HINTS AND SOLUTIONS

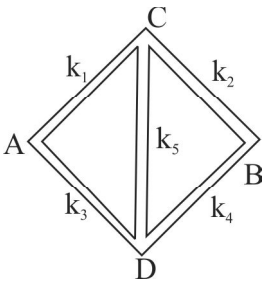
SUBJECT : PHYSICS

1. (1)

We can identify the source of a sound from the number of overtones present and their relative intensities.

2. (1)

Let x and A be the length and cross-sectional area of each rod



$\therefore$ Thermal resistance of the rod AC,

$$R_{AC} = \frac{x}{k_1 A}$$

Similarly,

$$R_{BC} = \frac{x}{k_2 A},\ R_{AD} = \frac{x}{k_3 A},\ R_{DB} = \frac{x}{k_4 A},$$

There will be no heat flow through the central rod CD if C and D are at the same temperature. Using electrical analogy for heat conduction, we get

$$\frac{R_{AC}}{R_{BC}} = \frac{R_{AD}}{R_{DB}} \text{ (Wheatstone bridge principle)}$$

$$\therefore \quad \frac{x/k_1 A}{x/k_2 A} = \frac{x/k_3 A}{x/k_4 A} \Rightarrow \frac{k_2}{k_1} = \frac{k_4}{k_2}$$

or $\quad k_1 k_4 = k_2 k_3$

3. (3)

Equating the total volume of 64 smaller drops with the volume of one large drop of radius R,

$$\frac{4}{3}\pi R^3 = 64 \times \frac{4}{3}\pi r^3 \Rightarrow R = 4r$$

Charge on bigger drop = 64q

Surface density of charge of a small drop,

$$\sigma_1 = \frac{q}{4\pi r^2}$$

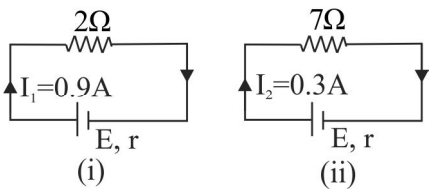
Surface density of charge of the bigger drop

$$\sigma_2 = \frac{64q}{4\pi R^2} = \frac{64q}{4\pi \times (4r)^2}$$

$$\therefore \frac{\sigma_1}{\sigma_2} = \frac{q}{4\pi r^2} \times \frac{4\pi \times (4r)^2}{64q} = \frac{1}{4}$$

4. (3)

Let E and r be emf and internal resistance of the cell respectively.



$$I_1 = \frac{E}{2+r} = 0.9 \ldots\ldots (i)$$

$$I_2 = \frac{E}{7+r} = 0.3 \ldots\ldots (ii)$$

Dividing (i) with (ii), $\frac{7+r}{2+r} = \frac{0.9}{0.3}$

$$\Rightarrow \ 2.1 + 0.3r = 1.8 + 0.9r$$

$\Rightarrow 0.6r = 0.3 \Rightarrow r = 0.5\Omega$

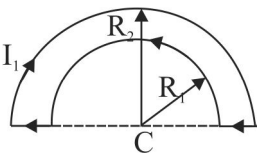
5. **(3)** 100% of the radiation incident on a open window gets transmitted, therefore absorption coefficient is zero.

6. **(1)** As all three prisms are identical, the ray of light suffers zero deviation when it moves from one prism to another. Hence, the combination functions as a single prism of same apex angle and the ray of light suffers same deviation as due to a single prism.

7. **(2)**

Magnetic field at the centre C of a semicircular conductor is given by $B = \sum dB$

$$= \sum \frac{\mu_0}{4\pi} \frac{Idl \sin 90^o}{r^2}$$



$$= \frac{\mu_0}{4\pi} \frac{I}{r^2} \sum dl = \frac{\mu_0}{4\pi} \frac{I}{r^2} (\pi r) = \frac{\mu_0 I}{4r}$$

Here, magnetic field at C due to the current in the circular loop of smaller radius, $\overrightarrow{B_1} = \frac{\mu_0 I}{4R_1}$, is acting upwards perpendicular to the plane o f the paper.

Magnetic field at C due to the current (I) in the circular loop of bigger radius, $\overrightarrow{B_2} = \frac{\mu_0 I}{4R_2}$, is acting downwards perpendicular to the plane of the paper.

The magnetic field due to the straight portions is zero at C.

Hence, magnitude of net magentic field at C

$$= \left|\overrightarrow{B_1}\right| - \left|\overrightarrow{B_2}\right|$$

$$= \frac{\mu_0 I}{4}\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{[directed upwards]}$$

8. **(3)** Using Conservation of energy,

$$\frac{1}{2}mv^2 = eV \Rightarrow v = \sqrt{\frac{2V}{m}}$$

$$\Rightarrow v = \sqrt{\frac{45.5 \times 1.6 \times 10^{-19} \times 2}{9.1 \times 10^{-31}}} = 4 \times 10^6 \text{ m/s}$$

9. **(2)**

Position of m^{th} bright fringe $= \frac{mD\lambda_1}{d} = y_m$

Given, $\lambda_1 = 6500\,\text{Å}$.

Position of n^{th} bright fringe due to $\lambda_2 = 5200\,\text{Å}$

$$y_n = \frac{nD\lambda_2}{d}$$

$$y_m = y_n \Rightarrow m \times 6500 = n \times 5200$$

$$\Rightarrow \frac{m}{n} = \frac{4}{5}$$

Hence for maximum distance from central maximum,

m = 8, n = 10.

10. **(1)**

As Lyman, Balmer and Paschen series correspond to UV, visible and IR wavelengths respectively, absorption lines will be observed for all three.

11. **(1)**

Magnetic susceptibility (χ) is defined as the ratio of intensity of magnetisation I to the intensity H of the magnetising field.

$\therefore \chi = I/H$

Diamagnetic substances possess very small and negative values of susceptibilities.

Hence OC represents the variation of I with respect to H in a diamagnetic substance as it has a small but negative slope $(= I/H)$.

12. (4)

Given, $I_C = 10$ mA.

As 90% electrons from emitter reach collector,

$$I_C = 0.9\ I_E \Rightarrow I_E = \frac{I_C}{0.9} = \frac{10}{0.9} \approx 11\text{mA}.$$

$$\therefore \quad I_B = I_E - I_C = 11 - 10 = 1\text{ mA}$$

13. (3) Supply voltage $= \sqrt{V_R^2 + (V_L - V_C)^2}$

$$= \sqrt{40^2 + (60-30)^2} = 50\text{ V}$$

14. (1)

As the convex and concave lenses have same focal lengths but opposite signs (positive and negative respectively), the combined focal length F is given by,

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} = 0 \Rightarrow F = \infty.$$

Hence the focus for the beam of parallel rays shifts to infinity.

15. (2)

Intensity of light falling on the caesium photocell in the second case will be one fourth of that in the first case $\left(\because \frac{50^2}{100^2} = \frac{1}{4}\right)$.

The number of photo electrons emitted is proportional to the intensity of light.

$\therefore$ Number of photo electrons emitted in the second case is one quarter of that in the first case.

16. (1)

3/4th nuclei decay in 2 half lives.

$$\left[\because \quad \frac{3}{4} = \frac{1}{2} + \left(\frac{1}{2} \times \frac{1}{2}\right)\right]$$

$$\therefore \text{ Half life } = \frac{3}{4} \times \frac{1}{2} = \frac{3}{8}\text{s}.$$

17. (3)

Upward velocity of the balloon after 8 s,

$$u = at = 1.25 \times 8 = 10\text{ m/s}$$

The stone is released at a height,

$$h = \frac{1}{2}at^2 = \frac{1}{2} \times 1.25 \times 8^2 = 40\text{m}$$

After release, the stone moves up with an initial speed $u = 10\,m/s$ before coming to rest and falling back to ground again.

Total dispalcement of the stone

$y = -40\text{ m}$.

Total distance covered by the stone

$$\text{S} = \text{h} + 2 \cdot \frac{u^2}{2g} = 40 + \frac{10^2}{10} = 50\text{m}$$

If the stone reaches ground after time t,

$$y = \text{ut} + \frac{1}{2}\text{g}\,\text{t}^2 \Rightarrow -40 = 10\,\text{t} - \frac{1}{2} \cdot 10\ \text{t}^2$$

$$\Rightarrow \text{t}^2 - 2\text{t} - 8 = 0 \Rightarrow (\text{t}-4)(\text{t}+2) = 0$$

Ignoring the negative root, $\text{t} = 4\,\text{s}$.

18. (4)

As there is no external force being applied on the student, he will not move.

19. (1)

"Infrared radiations arise due to minor electron transition in atoms" is not true.

20. (3)

Water forms a concave meniscus.

21. (4)

Let the thickness of one plank be x. When the speed of the bullet is 100ms^{-1}, it is able to penetrate two planks.

Using $v^2 = u^2 + 2as$,

$$0 = 100^2 + 2a \times 2x \Rightarrow 2a = -\frac{(100)^2}{2x}$$

When the speed of the bullet is doubled, let the number of planks it is able to penetrate be n.

$$\therefore \quad 0 = 200^2 + 2a \times nx$$

$$\Rightarrow (200)^2 = \frac{(100)^2}{2x} \times nx \Rightarrow n = 8$$

22. (3)

Time requied by the vertical plate to fall through a height h = 10 cm is given by ,

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times 10}{980}} = \frac{1}{7}\ s$$

The tuning fork completes 8 oscillations in $\frac{1}{7}$ s.

$\therefore$ Time period, $T = \frac{1}{7} \div 8 = \frac{1}{56}$ s

$\Rightarrow$ Frequency of the fork, f = 1/T = 56 Hz.

23. (4)

Number of beats formed by two tuning forks is equal to the difference in their frequencies.

Therefore, the frequencies of the forks form a arithmetic progression with common difference (d) equal to 5 and number of terms equal to 41.

Let f be the frequency of the first fork.

Then, $2f = f + (41-1)\times 5 \Rightarrow f = 200$ Hz.

24. (4)

Work done is equal to the area of the triangle

$$= \frac{1}{2} \times 2V \times P = PV$$

25. (2) Acceleration due to gravity $g = \frac{GM}{R^2}$

$$\therefore \frac{g}{G} = \frac{M}{R^2}$$

26. (3) As I increases, the strength of the electromagnet A increases and the flux linked with the aluminium ring B will also increase. Hence, an e.m.f will be induced in the ring B. According to Lenz's law of electromagnetic induction, the direction of induced e.m.f will be such that it opposes the very cause (here increase of flux linked with the ring) due to which it is created. Therefore, the ring will repel the electromagnet and as a reaction, the electromagnet A will repel the ring B.

The opposite will happen when I decreases, i.e., A and B will attract each other.

27. (3) As electric field inside the metal plate is zero, the effective separation between the plates becomes half of its original value. Therefore the effective capacitance doubles to become 2C.

28. (4)

Resistance of the wire R = $\rho\frac{l}{A}$

When the wire is cut into two parts, the resistance of each half becomes,

$$R' = \frac{\rho l/2}{A} = \frac{R}{2}.$$

When the two halves are connected in parallel, total effective resistance,

$$R'' = \frac{R'}{2} = \frac{R}{4} = \frac{6}{4} = 1.5\Omega.$$

29. (3) The material for a permanent magnet should have high retentivity so that the magnet is strong, and high coercivity so that the magnetisation is not wiped out by stray external fields, mechanical ill-treatment and temperature changes

30. (2)

$$[a] = [T^2]$$

Also $[Pbx] = [T^2]$

$$\Rightarrow [ML^{-1}T^{-2}][b][L] = [T^2]$$

$$\Rightarrow [b] = \frac{[T^2]}{[MT^{-2}]} = [M^{-1}T^4]$$

$$\therefore \left[\frac{a}{b}\right] = \frac{\left[T^2\right]}{\left[M^{-1}T^4\right]} = \left[MT^{-2}\right]$$

31. (4) Magnetic field at a point on the axis of a coil, located at a distance x from the centre of the coil of radius r, carrying current I, is given by

$$|B| = \frac{\mu_0}{4\pi}\frac{2\pi I r^2}{\left(r^2 + x^2\right)^{3/2}}$$

$$\therefore \frac{B_1}{B_2} = \left(\frac{r^2 + 0.2^2}{r^2 + 0.05^2}\right)^{3/2} = \frac{8}{1} \quad [\text{given}]$$

Solving for r, we get r = 0.1 m.

32. (3) The wavelength of radiation emitted by a body depends only on the temperature of the surface. The wavelength λ_m for maximum emission at a particular temperature T is given by Wien's displacement law,

$$\lambda_m T = b = \text{constant}$$

33. (2)

$$y = A\cos^2\left[2\pi nt - 2\pi\frac{x}{\lambda}\right]$$

$$\Rightarrow y = A\left[\frac{1 + \cos 2(2\pi nt - 2\pi x/\lambda)}{2}\right]$$

$$\Rightarrow y = \frac{A}{2} + \frac{A}{2}\cos\left(4\pi nt - 4\pi\frac{x}{\lambda}\right)$$

Comparing with standard wave equation amplitude = A/2, frequency = 2n,

wavelength $= \lambda/2$.

34. (2)

Packing fraction determines the stability of nucleus. It is defined as the mass excess per nucleon

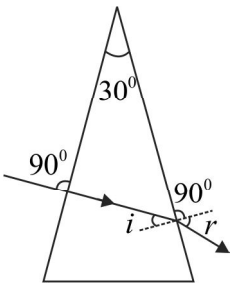
$$\text{Packing fraction} = \frac{M - A}{A}$$

where M is the actual mass of nuclide on atomic mass scale and A is mass number

35. (2)

As the forward bias across the diode increases, the width of depletion region decreases

36. (2)



As the ray of light is incident normally on the first face of the prism with apex angle $30°$, the angle of incidence on the second face,

$$i = 90° - (90° - 30°) = 30°.$$

Given refractive index $\mu = \sqrt{2}$, angle of refraction (r) is given by,

$$\sin(\text{r}) = \mu\sin(i) = \sqrt{2} \times \sin(30°) = \frac{1}{\sqrt{2}}$$

$$\Rightarrow \text{r} = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right) = 45°$$

Hence, angle of deviation $= 45° - 30° = 15°$

37. (4)

Number of atoms in 10 grams of copper

$$= \frac{6.023 \times 10^{23}}{63.5} \times 10 = 9.485 \times 10^{22}$$

$\therefore$ Number of electrons transferred from one ball to another $= \frac{9.485 \times 10^{22}}{10^6} = 9.485 \times 10^{16}$

The ball which looses electrons will be positively charged and the one which gains will be negatively charged.

$\therefore$ Magnitude of charge on each ball

$Q = 9.485\times10^{16}\times e$

[e = charge of an elctron]

$= 9.485\times10^{16}\times1.6\times10^{-19} = 15.176\times10^{-3}\,C$

$\therefore$ Coloumb force between them,

$$F = \frac{1}{4\pi\varepsilon_0}\frac{Q\times Q}{r^2}$$

Given, r = 10cm = 0.1m.

$$\therefore \quad F = \frac{9\times10^9\times\left(15.176\times10^{-3}\right)^2}{\left(0.1\right)^2}$$

$$= 2.072\times10^8\,N \simeq 2.0\times10^8\,N$$

38. (3)

Total resistance of n resistors in series,

$$R_t = \sum r_n$$

Total emf of n cells in series,

$$E_t = \sum E_n = \sum 1.5r_n = 1.5\sum r_n = 1.5R_t$$

Hence, current through the circuit,

$$I = \frac{E_t}{R_t} = 1.5\,A.$$

39. (3)

The magnetic field produced by a bar magnet is equivalent to that produced by a current carrying solenoid. A circular coil is equivalent to a magnetic dipole.

40. (4)

Cutoff wavelength = $\frac{hc}{W_0}$

$$= \frac{\left(6.6\times10^{-34}\times3\times10^8\right)}{4.125\times1.6\times10^{-19}} = 3\times10^{-7}\,m = 300\,nm$$

41. (2)

Work done = area enclosed in the PV curve

= area of rectangle

$= P\times V = PV$

42. (2)

White light is composed of a variety of colours/ wavelengths. Different wavelengths will produce bright and dark fringes of different fringe widths at different points of the screen. At any specific point there will be overlap of many wavelengths/colours.

A white bright fringe will be produced at the centre as path difference is zero there for all wavelengths.

As violet has minimum wavelength, the first order violet fringes will be visible closest to the central bright fringe.

43. (4)

When positively charged body is connected to the earth, electrons from earth flows to the body to neutralise its positive charge.

44. (2)

UV radiation of shortest wavelength are most harmful to living tissue.

45. (2)

For a given fuse wire material, the radius r of fuse wire and the maximum current I are related as $I^2 \propto r^3$.

$$\Rightarrow \left(\frac{I_2}{I_1}\right)^2 \propto \left(\frac{r_2}{r_1}\right)^3 \Rightarrow r_2 = \left(\frac{I_2}{I_1}\right)^{\frac{2}{3}} r_1.$$

Given, $I_1 = 1.5\,A$, $r_1 = 1$ mm, $I_2 = 3A$

$$\Rightarrow \quad r_2 = \left(\frac{3}{1.5}\right)^{\frac{2}{3}}\times1 = \sqrt[3]{4}\ \text{mm}$$

46. (3) Fundamental frequency of sonometer wire of length l, mass per unit length m and under tension T is given by,

$$n = \frac{1}{2l}\sqrt{\frac{T}{m}} = \frac{1}{2l}\sqrt{\frac{T}{\pi r^2\rho}} = \frac{1}{2lr}\sqrt{\frac{T}{\pi\rho}}$$

$$\therefore \quad \frac{n_1}{n_2} = \frac{l_2}{l_1}\cdot\frac{r_2}{r_1}\cdot\sqrt{\frac{T_1}{T_2}}\cdot\sqrt{\frac{\rho_2}{\rho_1}} = \frac{35}{36}\cdot\frac{1}{4}\cdot\sqrt{\frac{8}{1}}\cdot\sqrt{\frac{2}{1}} = \frac{35}{36}$$

Higher frequency $n_2 = 360\,\text{Hz}$.

$$\therefore\ n_1 = \frac{35}{36} \times 360 = 350\ \text{Hz}$$

$\therefore$ Number of beats/sec $= 360 - 350 = 10$

47. (4)

Laminated cores in transformers reduce the losses due to eddy currents.

48. (3)

In a bipolar junction transistor, the collector has the maximum thickness and the base region is the thinnest layer.

Therefore, $l_3 > l_1 > l_2$ is the correct option.

49. (4)

Let the distance between the two +Q charges be '2a'. Then the distance between q and either of the two +Q charges is 'a'.

As the forces on q by the two +Q charges are equal and opposite, it is in equilibrium.

For the equilibrium of the +Q charges, total force on either of them should be zero. Hence,

$$\frac{1}{4\pi \in_0}\frac{Qq}{a^2} + \frac{1}{4\pi \in_0}\frac{Q^2}{(2a)^2} = 0 \Rightarrow q = -\frac{Q}{4}$$

50. (1)

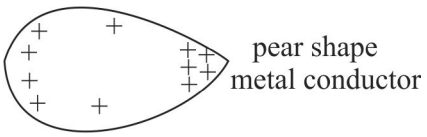
All particles in a stationary wave cross the mean position at the same instant of time, but with different velocities.

51. (4)

The resistance of an incandescent lamp is greater when switched on because the resistance of the filament increases with temperature. As the temperature of an incandescent lamp increases rapidly after it is switched on, its resistance also increases.

52. (1)

In case of spherical metal conductor the charge quickly spreads uniformly over the entire surface because of which a uniform average electric field is created near the conductor and charges stay for longer time on the spherical surface. In case of non-spherical surface, the charge concentration is different at different points due to which high electric field is created at some places near the conductor and charges do not stay on the surface for longer time. For example, in a pear shaped conductor charge is more concentrated on curved regions and less concentrated on the flat regions. Also, charge density is higher at the smaller pointed end.



53. (2)

The number of electrons ejected per second in photoelectric effect is proportional to the intensity of the incident light.

54. (3)

The de-Brogile wavelength of an electron is given by : $\lambda = h / mv$ .....(i)

From Bohr's postulates of atomic structure we have

$$mvr = \frac{nh}{2\pi}$$

[Angular momentum = integral multiple of $h/2\pi$]

$\therefore$ For the first Bohr orbit , n = 1.

$$\therefore\ mvr = \frac{h}{2\pi} \Rightarrow mv = \frac{h}{2\pi r} \quad \text{.....(ii)}$$

From (i) and (ii) we get,

$$\lambda = \frac{h}{h/2\pi r} = 2\pi r \text{ (circumference of first orbit)}$$

55. (4)

de Brogile wavelength λ for an electron of mass m and energy E,

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mE}} \qquad \text{.....(i)}$$

After wavelength of the electron is reduced to λ', if its energy is E', then

$$\lambda' = \frac{h}{\sqrt{2mE'}} \quad \text{.....(ii)}$$

Dividing (i) with (ii),

$$\frac{\lambda}{\lambda'} = \sqrt{\frac{E'}{E}} \Rightarrow \frac{E'}{E} = \left(\frac{\lambda}{\lambda'}\right)^2$$

Given, $\lambda = 1$ nm and $\lambda' = 0.5$ nm,

$$\frac{E'}{E} = \left(\frac{1}{0.5}\right)^2 \Rightarrow E' = 4E$$

$\therefore$ The energy to be added to decrease the electron's wavelength = $E' - E = 3E$

56. (2)

Resolving power of a telescope

$$= \frac{1}{\delta\theta} = \frac{D}{1.22\lambda}$$

where $\delta\theta$ is the smallest angular separation between two distinct objects whose images can be seen in a telescope as separate, and D is the aperture of the objective lens. Therefore, to increase resolving power, aperture (D) has to be increased.

Magnification of a telescope is given by

$$M = \left|\frac{f_o}{f_e}\right|, \text{ for normal adjustment}$$

$$= \left|\frac{f_o}{f_e}\left(1 + \frac{f_e}{d}\right)\right|,$$

for final image at least distance of distinct vision (d). Here f_o and f_e are the focal lengths of the objective and eye-piece respectively.

To increase magnifying power, focal length of the objective (f_o) has to be increased

57. (4)

58. (4) In a p-n junction, potential on the n-side of the depletion region is higher than that on the p-side.

Due to forward biasing, the height of potential barrier across the depletion region decreases.

59. (4)

Gain in K.E. as the charged ball is accelerated from point A to point B,

$$= 600 \times 10^{-8} = 6 \times 10^{-6} \text{ J}.$$

K.E. of the ball at B = $\frac{1}{2}mv^2$

$$= \frac{1}{2} \times 10^{-3} \times (0.2)^2 = 2 \times 10^{-5} \text{ J}.$$

$\therefore$ K.E. at A $= 2 \times 10^{-5} - 6 \times 10^{-6} = 14 \times 10^{-6}$ J.

$\therefore$ Velocity at A

$$= \sqrt{\frac{14 \times 10^{-6} \times 2}{10^{-3}}} = 0.167 \text{ ms}^{-1} = 16.7 \text{ cms}^{-1}$$

60. (4)

Resistance of the coil,

$$R = \frac{V_{DC}}{I_{DC}} = \frac{100}{1} = 100\Omega.$$

When 100 V AC is applied, in addition to the resistance, the reactance of the coil will also impede the flow of current.

Let L be the inductance of the coil.

Total impedance of the coil,

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{R^2 + (2\pi fL)^2}$$

[Frequency, f = 50Hz]

$\therefore$ Current, $I = \frac{V}{Z} = \frac{V}{\sqrt{R^2 + (2\pi fL)^2}}$

$$\Rightarrow 0.5 = \frac{100}{\left\{(100)^2 + (2\pi \times 50 \times L)^2\right\}^{1/2}}$$

$$\Rightarrow 2500 + 24674L^2 = 10000$$

$$\therefore L = \sqrt{\frac{10000 - 2500}{24674}} = 0.55 \text{ H.}$$

SUBJECT : CHEMISTRY

61. (2) Given, $\frac{d[C]}{dt} = 2.8 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$

For the given reaction,

$$2A + 3B \rightarrow 4C + D$$

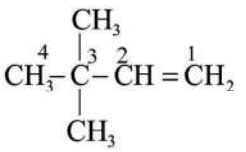
Rate of reaction =

$$-\frac{1}{3}\frac{d[B]}{dt} = \frac{1}{4}\frac{d[C]}{dt}$$

or $$-\frac{d[B]}{dt} = \frac{3}{4}\frac{d[2.8\times10^{-3}] \text{ with } [C]}{dt} \text{mol L}^{-1}\text{ s}^{-1}$$

$$= \frac{3}{4}(2.8\times10^{-3}) \text{mol L}^{-1}\text{s}^{-1}$$

62. (4)



3, 3 dimethyl-1-butene

63. (1) $\frac{r_H}{r_A} = \sqrt{\frac{M_A}{M_H}} \Rightarrow 6 = \sqrt{\frac{M_A}{2}}$

$$\Rightarrow 36 = \frac{M_A}{2} \Rightarrow M_A = 72$$

64. (3) According to Le Chatelier's principle if the pressure is increased, reaction will take place in a direction which will bring about a lowering of vapour pressure. This implies that equilibrium will shift in the direction which produces the smaller number of gas molecules

65. (1) Butylated hydroxy anisole (BHA) is a waxy solid used as a food additive acts an antioxidant which prevents the food from getting rancid.

66. (4) For *f* orbital ($l = 3$) the values of *m* are –l to +l i.e., –3, –2, –1, 0, +1, +2, +3.

67. (1) From Nernst equation, we have

$$E_{cell} = E^o_{cathode} - E^o_{anode} - \frac{2.303RT}{nF}\log K$$

At equilibrium, $E_{cell} = 0$

Therefore, $$\log K = \frac{n\left(E^o_{cathode} - E^o_{anode}\right)}{\left(\frac{2.303RT}{F}\right)} \quad (1)$$

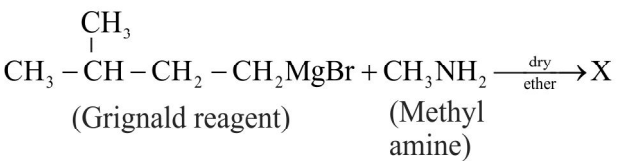
Substituting the values in Eq. (1), we get

$$\log K = \frac{2\times(0.76 - 0.55)}{0.06}$$

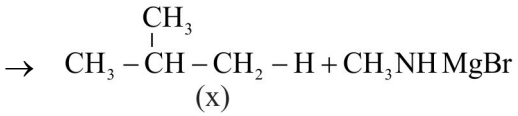
$$\Rightarrow K = 1\times10^7$$

68. (1) Lone pair of electrons are those electrons which present in the valence shell of an atom and does not take part in bonding (except, when required).

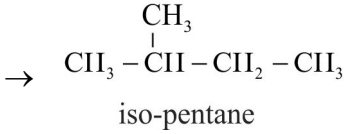
69. (3)



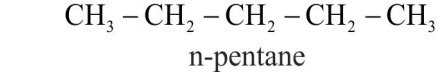
(Grignald reagent) (Methyl amine)



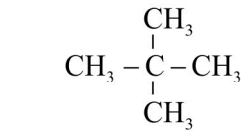
(x)



iso-pentane



n-pentane



neo-pentane

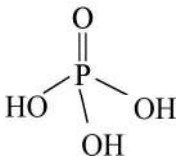
70. **(1)** The reaction involved is

$$\text{Sulphide ore} \xrightarrow{\text{Roasting}} \underset{(X)}{SO_2(g)}$$

$$\underset{(X)}{SO_2(g)} + Cl_2(g) \xrightarrow[\text{charcoal}]{\text{Adctivated}} \underset{(Y)}{SO_2Cl_2}$$

71. **(1)** Since, halides and oxides of p-block element on hydrolysis gives corresponding acid, therefore, PCl_5 on hydrolysis gives orthophosphoric acid. The reaction involved is

$$\overset{+5}{PCl_5} + 4H_2O \rightarrow \underset{\text{Orthophosphoric acid}}{\overset{+5}{H_3PO_4}} + 5HCl$$



H_3PO_4 is tribasic acid becuase it has three OH groups attached to P.

72. **(3)** The half-life period of n^{th} order reaction is $t_{1/2} = \frac{k}{a^{n-1}}$ (Where, a is the initial concentration of reactant). $t_{1/2} \propto \frac{1}{a^3}$. $\therefore$

$$t_{1/2} = \frac{k}{a^3}.$$

$$\frac{k}{a^{n-1}} = \frac{k}{a^3} \Rightarrow a^3 = a^{n-1}$$

$$\Rightarrow n-1 = 3 \Rightarrow n = 4 .$$

$\therefore$ The order of the reaction is 4.

73. **(1)** Sodium aluminium silicate is used in the softening of hard water.

74. **(1)** Anemulsifier is a substance which stabilises the emulsion by increasing its kinetic stability.

In egg yolk the main emulsifying agent is lecthin.

Other examples of emulsifires include soy lecithin, sodium phosphates and sodium stearoyl lactylate.

Stabilises the emulsion.

75. **(3)** Lead form nitric oxide with dil HNO_3. It does not form ammonium nitrate by reaction with dilute nitric acid

$$3Pb + 8HNO_3 \rightarrow 3Pb(NO_3)_2 + 2NO + 4H_2O$$

76. **(1)** Primary valency corresponds to the oxidation state of the central metal and secondary valency represents the coordination number of the metal. A negative ion when present in the co-ordination sphere shows a dual behaviour.

77. **(4)** The the correct IUPAC name of the given complex is tetraamine platinium (II) tetrachloridoplatinate(II).

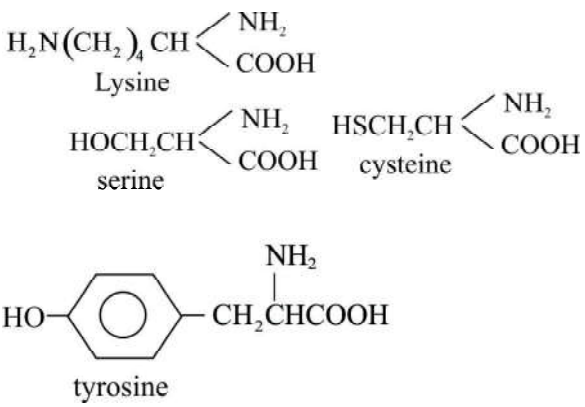
78. **(2)** On heating with silver salts of fatty acid i n alcoholic solution, alkyl halides yield esters.

$$R'COOAg + XR \rightarrow R'COOR + AgX$$

$$CH_3COOAg + BrC_2H_5 \rightarrow CH_3COOC_2H_5 + AgBr$$

79. **(2)** Among the given options pepsin, ptyalin and lipse are enzymes. However, cellulose is polysaccharide.

80. **(3)**



81. **(3)** $\underset{48\,gm}{2Mg} + \underset{1\,mole}{O_2} \rightarrow 2MgO$

1 mole of O_2 combines with 48 g of Mg

$\Rightarrow$ 1.5 mole O_2 combines with

$1.5 \times 48 = 72\,g$ of Mg

82. **(3)** 3 gram of an oxide of metal is converted to chloride completely.

It yielded 5 gram of chloride.

Equivalent weight of metal is 'E'

$$\therefore \frac{E+35.5}{5} = \frac{E+8}{3}$$

$$\Rightarrow 5E + 40 = 3E + 106.5 \Rightarrow E = 33.25$$

83. **(2)** A chemical bond may be regarded as a force which holds the atoms together in a molecule. When two isolated atoms get very close to each other besides force of attraction, there also develop force of repulsion between the two nuclei and electrons of like charge. At a short internuclear distance the attractive force due to sharing, gaining or losing electrons just balance the repulsive forces between particles of like charge, at which the molecules attain maximum stability.

84. **(1)** According to Graham's law of diffusion

$$\frac{r_1}{r_2} = \sqrt{\frac{d_2}{d_1}} = \sqrt{\frac{M_2}{M_1}}, \frac{r_{NH_3}}{r_{HCl}} = \sqrt{\frac{36.5}{17}}$$

The rate of diffusion of NH3 is more than HCl and it reach first to HCl end.

Hence white ring of NH_4Cl appears first at HCl end.

85. **(3)** Hypothyroidism is caused by the deficiency of thyroxine in which the body produces little amount of thryoxine.

86. **(2)** Antagonist are the drug that binds to the receptor site and inhibit its function.

87. **(3)** According to Gibb's Helmholtz equation, change in free energy, $\Delta G = \Delta H - T\Delta S$.

For a spontaneous process, ΔG must be negative.

Therefore, ΔG may be greater, smaller or equal to ΔH depending on sign and magnitude of $T\Delta S$

88. **(1)** As the physical state is also changed in second reaction, so the value of ΔH_2 will be greater than ΔH_1.

89. **(1)** For a solution to be isotonic, the osmotic pressure must be equal.

$$\Rightarrow \Pi_1 = \Pi_2$$

We know

$$\Pi = iCRT$$

For 0.01 M $BaCl_2$

$$\Pi_{BaCl_2} = 3 \times 0.01RT = 0.03RT$$

For 0.015 M NaCl

$$\Pi_{NaCl} = 2 \times 0.015RT = 0.03RT$$

Hence, $\Pi_{BaCl_2} = \Pi_{NaCl} = 0.03RT$

90. **(4)** Sodium acetate is a strong electrolyte.

91. **(4)** Initial state $\underset{1}{A} + \underset{1}{B} \rightleftharpoons \underset{0}{C} + \underset{0}{D}$

At equilibrium $1-\frac{1}{3}$ $1-\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$

$$K_C = \frac{[C][D]}{[A][B]} = \frac{\frac{1}{3} \times \frac{1}{3}}{\frac{2}{3} \times \frac{2}{3}} = \frac{1}{4} = 0.25$$

92. **(4)** Ethylene is formed by the action of alcoholic KOH on ethyl iodide

$$C_2H_5I + KOH(alc.) \rightarrow C_2H_4 + KI + H_2O$$

C_2H_4 decolourises alkaline $KMnO_4$ to form ethylene glycol.

$$C_2H_4 \xrightarrow[H_2O+O]{KMnO_4(alk.)} \underset{\text{Ethylene glycol}}{\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix}}$$

93. **(4)** The function of $AlCl_3$ in Friedel-Crafts reaction is to produce electrophile

$$CH_3Cl + AlCl_3 \rightarrow CH_3^+ + AlCl_4^-$$

or $\underset{\text{Electrophile}}{RCl + AlCl_3 \rightarrow R^+ + AlCl_4^-}$

94. (2) When BF_3 (Lewis acid) reacts with $LiAlH_4$ in ether medium gives highly toxic gas, B_2H_6. The reaction involved is

$$4BF_3 + 3LiAlH_4 \rightarrow 2B_2H_6 + 3LiF + 3AlF_3$$

When B_2H_6 is heated with NH_3 it gives $B_3N_3H_6$ (inorganic benzene). The reaction involved is

$$B_2H_6 + 6NH_3 \rightarrow \underset{\substack{\text{Benzene}\\(\text{Inorganic bezene})}}{2B_3N_3H_6} + 12H_2$$

95. (4) This distance between sodium and chloride ions = X pm

The distance between two chloride ions

$$= \sqrt{X^2 + X^2} = \sqrt{2X^2} = X\sqrt{2}$$

$$r_{Cl^-} = \frac{X\sqrt{2}}{2}$$

In a face-centred cubic lattice, anions touch each other along the face diagonal of the cube.

$$a = \frac{4r_{Cl^-}}{\sqrt{2}} = \frac{4X\sqrt{2}}{\sqrt{2}.(2)} = 2X$$

96. (2) Schottky defect in the crystals lowers its density as it is caused if some of the lattice points are unoccupied. The points which are unoccupied are called vacancies or holes. The number of missing positive and negative ions is the same in this case and thus, the crystal remains neutral.

97. (4) Since, alkyl halide $(CH_3)_3C-Cl$ gives elimination over substitution reaction due to the formation of more substituted alkene and alkyl halide $C_6H_5CH=CHCl$ does not give substitution reaction, as it is a vinyl halide. Therefore, the most stable ethers is form by $C_6H_5CH_2Br$ and C_6H_5ONa. The reaction invovled is

$$C_6H_5CH_2Br + CH_3ONa \rightarrow C_6H_5CH_2OCH_3 + NaBr$$

$$C_6H_5ONa + CH_3Br \rightarrow C_6H_5OCH_3 + NaBr$$

98. (2) Hinsberg's reagent is benzene sulphonyl chloride $C_6H_5SO_2Cl$, which used to distinguish the $1°, 2°$ and $3°$ amines.

99. (2) $\underset{0.4g}{H_2} + \underset{7.1g}{Cl_2} \rightarrow 2HCl$

$$\text{Moles of } H_2 = \frac{0.4}{2} = 0.2\,\text{mol}$$

$$\text{Moles of } Cl_2 = \frac{7.1}{71} = 0.1\,\text{mol}$$

From the reaction, one mole of H_2 react with one mole of Cl_2 to form two moles of HCl.

Here, Cl_2 is limiting reagent.

$\Rightarrow 71\text{g of } Cl_2$ gives 2*22.7 of HCl

$$\Rightarrow 71\text{g of } Cl_2 \text{ will give} = \frac{2\times 22.71}{71}\times\frac{71}{10}\text{ L of HCl}$$

$\Rightarrow$ Volume of HCl = 4.54 L

100. (2) Guanine is purine derivative.

101. (2) For atomic number 9, electronic configuration - $1s^2 2s^2 2p^5$.

For atomic number 17, electronic configuration - $1s^2 2s^2 2p^6 3s^2 3p^5$

The elemetns show ns^2np^5 configuration which represents halogens.

102. (4) Methanal is manufactured by controlled oxidation of methane by air in presence of various metallic oxides as catalyst.

$$CH_4 + O_2 \xrightarrow[\text{catalyst}]{\text{Mo-oxide}} \underset{\text{methanal}}{HCHO} + H_2O$$

103. (3) (i) Pure alumina is a bad conductor of electricity.

(ii) The fusion temperature of pure alumina is about $2000^{o}C$ and at this temperature when the electrolysis is carried of fused mass, the metal formed vapourises as the boiling point of aluminium is $1800^{o}C$ The above difficulties are overcome by using a mixture of alumina, cryolite and fluorspar.

104. (1) Cuprite (Cu_2O) is cuprous ore of copper..

105. (3) The carbonyl compound undergo Aldol condensation must have an α – hydrogen atom.

(i) $\underset{\alpha}{CH_3}-\overset{O}{\overset{\|}{C}}-\underset{\alpha}{CH_3}$: 6 α – Hydrogen is present

(ii) $H-\underset{\alpha}{C}(Cl)(Cl)-\overset{O}{\overset{\|}{C}}-H$: 1 α – Hydrogen is present

(iii) $Cl-\underset{\alpha}{C}(Cl)(Cl)-\overset{O}{\overset{\|}{C}}-H$: 0 α – Hydrogen is present

(iv) $H_3\underset{\alpha}{C}-\overset{O}{\overset{\|}{C}}-H$: 3α Hydrogen is present

Therefore, due to the absence of α -hydrogen in CCl_3CHO , it does not undergo Aldol condensation reaction.

106. (1) Alum contains many cations and water has many anionic impurities. On adding alum coagulates the suspended impurities and make water fit for drinking purposes.

107. (2) Mercury has the property of dissolving nearly all metals, forming liquid or solid solutions called amalgams. It amalgamates well with gold, silver and tin, but does not dissolve iron or platinum. Presence of these may result in sickening or flouring of the mercury.

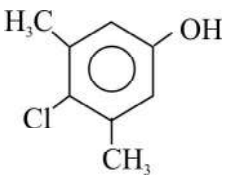
108. (2) Shape of $\left[Cu(NH_3)_4\right]^{2+}$ is square planar.

109. (4) Mohr's salt is a double salt when dissolved in water it dissociates into its constitutent ions. i.e. the individual components retain their identity.

$$FeSO_4.(NH_4)_2SO_4.6H_2O \rightarrow Fe^{2+}(\text{aqueous})$$

$$+2NH_4^{+}(aq) + 2SO_4^{--}(aq) + 6H_2O\,.$$

110. (4)



4-chloro-3, 5-dimethyl phenol is called dettol.

111. (1) Since, $C_2H_5OC_2H_5$ and $C_3H_7OCH_3$ have same fuctional gorup but have different alkyl groups attracted to oxygen atom, therefore they are metamers not functional isomers.

112. (1) 20 volume of H_2O_2 means 20 cc of oxygen obtained from 1 cc H_2O_2

$= 20$

$\therefore$ 5000 cc of oxygen obtained from

$$= \frac{5000}{20} cc\,H_2O_2 = 250\,cc\,H_2O_2$$

113. (1)

114. (1) $HC \overset{1\sigma}{\underset{2\pi}{\equiv}} CH$.

115. (4) LPG is chiefly a mixture of butane and isobutane.

116. (1) A chemical reaction was carried out at 300 K and 280 K.

For every 10^{o} rise in temperature, the rate of the reaction becomes nearly double.

$A \rightarrow$ product

At 300 K, $\text{rate}_1 = K_1[A_1]$

At 280 K, $\text{rate}_2 = K_2[A_2]$

Temperature coefficient $= \frac{K_{290}}{K_{280}} = 2$.

$K_1 \approx 4K_2 \ \therefore \ K_2 = \frac{1}{4}K_1 \approx 0.25K_1$

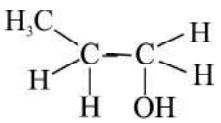
$K_2 \approx 0.25K_1$.

117. (3) The reaction involved in conversion of propan-2-ol to propan-1-ol is

(i)

$$CH_3 - \underset{\underset{OH}{|}}{CH} - CH_3 \xrightarrow[PCl_5]{\Delta} CH_3 - \underset{\underset{Cl}{|}}{CH} - CH_3$$

(ii) $CH_3 - \underset{\underset{Cl}{|}}{CH} - CH_3 \xrightarrow[\Delta]{alk.KOH} CH_3 - CH = CH_3$

(iii) $CH_3CH=CH_2 \xrightarrow[\text{Oxidation}]{BH_3}$ 

Propan-1-ol

118. (2) $k = \frac{2.303}{192}\log 16$

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{\frac{2.303}{192} \times 4\log 2} = 48\,\text{min}$$

119. (1) The reactions involved are

$$\underset{\text{Salt A}}{Na_2SO_3(aq)} + BaCl_2(aq) \longrightarrow BaSO_3(s) + 2NaCl(aq)$$

$$BaSO_3(s) + 2HCl(aq) \rightarrow BaCl_2(aq) + \underset{(B)}{SO_2(g)} + H_2O(l)$$

$$5SO_2(g) + 2MnO_4^-(aq) + 2H_2O(l) \rightarrow 5SO_4^{2-}(aq) + 4H^+(aq) + 2Mn^{2+}(aq)$$

120. (2) Since, Vitamin B_6 is water soluble vitamin, therefore it will not store in adipose tissue.

SUBJECT : MATHS

121. (4)

$$S_n = 0 + \frac{2}{3} + \frac{8}{9} + \frac{26}{27} + \frac{80}{81} + \ldots\ldots\ldots + n \text{ terms}$$

$$S_n = \frac{2}{3} + \frac{8}{9} + \frac{26}{27} + \ldots\ldots\ldots + t_{n-1} + t_n$$

Subtracting, $0 = \frac{2}{3} + \frac{2}{9} + \frac{2}{27} + \frac{2}{81}\ldots\ldots\ldots - t_n$

$$t_n = 2\left(\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \ldots\ldots\ldots - t_{n-1}\right)$$

$$= 2\left[\frac{(1/3)\left\{1-(1/3)^n\right\}}{1-(1/3)}\right] = 1 - 3^{-n}$$

$t_1 = 1 - 3^{-1}, \ t_2 = 1 - 3^{-2} \ldots . \ t_n = 1 - 3^{-n}$

Adding; $S_n = n - \left(3^{-1} + 3^{-2} + \ldots . 3^{-n}\right)$

$$= n - \frac{\frac{1}{3}\left(1 - \frac{1}{3^n}\right)}{1 - \frac{1}{3}} = n - \frac{1}{2}\left(1 - 3^{-n}\right)$$

122. (2)

$$= \frac{\frac{\pi}{3} - \frac{2\pi}{3}}{\frac{-\pi}{4} + \frac{2\pi}{3}}$$

$$= \frac{\frac{-\pi}{3}}{\frac{5\pi}{12}} = -\frac{4}{5}$$

123. (3) $\int_{-1}^{1}|1-x|dx$

$-1\le x\le 1\Rightarrow 1-x\ge 0$

$=\int_{-1}^{1}(1-x)\,dx=\left[x-\frac{x^2}{2}\right]_{-1}=2$

124. (4) $\pm\frac{\vec{a}\times\vec{b}}{\left|\vec{a}\times\vec{b}\right|}$ are unit vectors perpendicular to the plane of $\vec{a}$ and $\vec{b}$.

$\therefore$ Required vector is :

$$\pm\frac{\left(\hat{i}-\hat{j}+\hat{k}\right)\times\left(-\hat{i}+\hat{j}+\hat{k}\right)}{\left|(i-j+k)\times\left(-\hat{i}+\hat{j}+\hat{k}\right)\right|}$$

$$=\pm\frac{\left(-\left(\hat{i}+\hat{j}\right)\right)}{\sqrt{2}}\,i.e.\frac{-\left(\hat{i}+\hat{j}\right)}{\sqrt{2}}\,and\,\frac{\hat{i}+\hat{j}}{\sqrt{2}}$$

125. (3) Let $I=\int_{-\pi/2}^{\pi/2}\frac{\cos x}{1+e^x}dx$ (1)

$$\Rightarrow I=\int_{-\pi/2}^{\pi/2}\frac{\cos\left(\frac{\pi}{2}-\frac{\pi}{2}-x\right)}{1+e^{(\pi/2-\pi/2-x)}}dx=\int_{-\pi/2}^{\pi/2}\frac{\cos x}{1+e^{-x}}dx$$

$$\Rightarrow I=\int_{-\pi/2}^{\pi/2}\frac{e^x\cdot\cos x}{1+e^x}dx \qquad (2)$$

Adding Eqs. (1) and (2), we get

$$2I=\int_{-\pi/2}^{\pi/2}\frac{\cos x}{1+e^x}dx+\int_{-\pi/2}^{\pi/2}e^x\frac{\cos x}{1+e^x}dx$$

$$=\int_{-\pi/2}^{\pi/2}\frac{\cos x}{1+e^x}(1+e^x)dx=\int_{-\pi/2}^{\pi/2}\cos x\,dx$$

$$2I=[\sin x]_{\frac{-\pi}{2}}^{\frac{\pi}{2}}=\sin\frac{\pi}{2}--\sin\left(\frac{-\pi}{2}\right)$$

$2I=1-(-1)\Rightarrow 2I=2\Rightarrow I=1$

126. (1)

$$\lim_{x\to\pi}\frac{\sqrt{2+\cos x}-1}{(\pi-x^2)}$$

Put $x-\pi=t$

$$\lim_{t\to 0}\frac{\sqrt{2+\cos(\pi+t)}-1}{t^2}$$

$$=\lim_{t\to 0}\frac{\sqrt{2-\cos t}-1}{t^2}$$

$$=\lim_{t\to 0}\frac{2-\cos t-1}{t^2}\times\frac{1}{\sqrt{2-\cos t}+1}$$

$$=\lim_{t\to 0}\left(\frac{1-\cos t}{t^2}\right)\times\lim_{t\to 0}\left(\frac{1}{\sqrt{2-\cos t}+1}\right)$$

$$=\frac{1}{2}\times\frac{1}{\sqrt{2-1}+1}=\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$$

127. (1) $\frac{b+c}{11}=\frac{c+a}{12}=\frac{a+b}{13}=k$

$\therefore b+c=11k, c+a=12k, a+b=13k$

Adding $2(a+b+c)=36k$

$\therefore a+b+c=18k$

$\therefore a=18k-(b+c)=18k-11k=7k$

$b=18k-(c+a)=18k-12k=6k$

$c=18k-(a+b)=18k-13k=5k$

$$\therefore\cos C=\frac{a^2+b^2-c^2}{2ab}$$

$$=\frac{49k^2+36k^2-25k^2}{2(7k)(6k)}$$

$$=\frac{85-25}{2\times 7\times 6}=\frac{60}{2\times 7\times 6}=\frac{5}{7}$$

128. (3) $2^4 = 1 \bmod 5; \Rightarrow \left(2^4\right)^{75} \equiv (1)^{75} \bmod 5$

$i.e\ 2^{300} = 1 \bmod 5; \Rightarrow 2^{300} \times 2 \equiv (1)(2) \bmod 5$

129. (1) $n(A)$ = Sum of coefficient of odd powers of x in $\{(x^2+x)^3 = x^3(1+x)^3\}$

$= {}^3C_0 + {}^3C_2 = 1+3 = 4$

$\therefore P(A) = \dfrac{4}{2^3} = \dfrac{4}{8} = \dfrac{1}{2}.$

130. (2) Number of lines = ${}^nC_2 - {}^pC_2 + 1$

131. (4)

Let $I = \int_0^1 \dfrac{\log(1+x)}{1+x^2}dx$

Let $x = \tan\theta \Rightarrow dx = (\sec^2\theta)d\theta$

So, limits change from

$x = 0 \Rightarrow \theta = 0$ *and* $x = 1 \Rightarrow \theta = 45 = \pi/4$

Then, $I = \int_0^{\pi/4} \dfrac{\log(1+\tan\theta)}{1+\tan^2\theta}\sec^2\theta d\theta$

$= \int_0^{\pi/4} \dfrac{\log(1+\tan\theta)}{\sec^2\theta}\sec^2\theta d\theta$

$I = \int_0^{\pi/4} \log(1+\tan\theta)\,d\theta \qquad (1)$

We know that $\tan\theta = \tan\left(\dfrac{\pi}{4} - \theta\right)$, *we get*

$I = \int_0^{\pi/4} \log\left(1+\tan\left(\dfrac{\pi}{4}-\theta\right)\right)d\theta$

We also know that

$\tan(A-B) = \dfrac{\tan A - \tan B}{1+\tan A\tan B}$

So, $I = \int_0^{\pi/4} \log\left(1+\dfrac{\tan\pi/4 - \tan\theta}{1+\tan\pi/4\tan\theta}\right)d\theta$

$I = \int_0^{\pi/4} \log\left(1+\dfrac{1-\tan\theta}{1+\tan\theta}\right)d\theta = \int_0^{\pi/4} \log\left(\dfrac{2}{1+\tan\theta}\right)d\theta$

$I = \int_0^{\pi/4} \left(\log 2 - \log(1+\tan\theta)\right)d\theta$

From Eq. (1), we get

$I = \int_0^{\pi/4} (\log 2 d\theta) - I$

$2I = \int_0^{\pi/4} \log 2\ d\theta$

$2I = \log 2 \int_0^{\pi/4} d\theta = 2I = \log 2\left[\theta\right]_0^{\frac{\pi}{4}}$

$2I = \log 2\left[\dfrac{\pi}{4} - 0\right]$

$\therefore \quad I = \dfrac{\pi}{8}\log 2$

132. (2) The slops of the line joining (-4, 6) and (8, 8) is $\dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{8-6}{8+4} = \dfrac{2}{12} = \dfrac{1}{6}$

The midpoint of this line is

$\left(\dfrac{-4+8}{2}, \dfrac{8+6}{2}\right) = (2,7)$

$\therefore$ The equation of the line segment bisecting perpendicularly the given line is

$y - y_1 = m(x - x_1)$

i.e. $y - 7 = -6(x-2)$

i.e. *i.e.* $y - 7 = -6x + 12$ ie. $6x + y - 19 = 0$

133. (4) $A=\begin{bmatrix}\cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta\end{bmatrix}$

$|A|=\cos^2 2\theta+\sin^2 2\theta=1$

$\therefore A^{-1}=\begin{bmatrix}\cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta\end{bmatrix}$

134. (4) $\begin{vmatrix}41 & 42 & 43\\ 44 & 45 & 46\\ 47 & 48 & 49\end{vmatrix} \Rightarrow \begin{matrix}R_3\to R_3\to R_2\\ R_2\to R_2\to R_1\end{matrix}$

$=\begin{vmatrix}41 & 42 & 43\\ 3 & 3 & 3\\ 3 & 3 & 3\end{vmatrix}=9\begin{vmatrix}41 & 42 & 43\\ 1 & 1 & 1\\ 1 & 1 & 1\end{vmatrix}$

$=9\begin{vmatrix}41 & 42 & 43\\ 1 & 1 & 1\\ 0 & 0 & 0\end{vmatrix}\left(R_3\to R_3-R_2\right)=0$

135. (3)

We know

$\left|\overline{a}-\overline{b}\right|^2=|\overline{a}|^2+|\overline{b}|^2-2\overline{a}\cdot\overline{b}$

$\left|\overline{a}-\overline{b}\right|^2=(1)+(1)-2\,|\overline{a}|\,|\overline{b}|\cos\theta$

$\left|\overline{a}-\overline{b}\right|^2=2-2\cos\theta$

$\left|\overline{a}-\overline{b}\right|^2=2(1-\cos\theta)$

$\left|\overline{a}-\overline{b}\right|^2=2\times 2\sin^2\frac{\theta}{2}$

$\left|\overline{a}-\overline{b}\right|^2=4\sin^2\frac{\theta}{2}$

$\therefore \quad \sin^2\frac{\theta}{2}=\frac{\left|\overline{a}-\overline{b}\right|^2}{4}$

$\therefore \quad \sin\frac{\theta}{2}=\frac{1}{2}\left|\overline{a}-\overline{b}\right|$

136. (3) Substituting $x=1$, the sum of coefficients $=\left(1+x-3x^2\right)^{3148}=(-1)^{3148}=1$.

137. (4) The point of intersection of $x+y=6$ and $x+2y=4$ will give centre of circle.

$\therefore -y=2\Rightarrow y=-2$ *and* $x=8$

$\therefore$ *eq^n of circles with radius r is*

$(x-8)^2+(y+2)^2=r^2$

it passes through (6, 2)

$\therefore (6-8)^2+(4)^2=r^2$

$(2)^2+(4)^2=r^2 \quad \therefore r=\sqrt{20}$

138. (None is correct)

$\tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\frac{x+y}{1-xy}\right)=\tan^{-1}(1)$

$\Rightarrow x+y=1-xy;\ x+y+xy-1=0$

139. (2)

Given circle

$x^2+y^2-8x+4y+4=0$

Center = (4,-2)

Radius $=\sqrt{16+4-4}=4$

Here Radius = x- cordinate of center

$\therefore$ Circle touches *y*-axis

140. (3) $y=x^3-3x^2-9x+5$

$\Rightarrow \frac{dy}{dx}=3x^2-6x-9$

At the tangent $dy/dx=0$

$\therefore 3x^2-6x-9=0$. Solving $x=3,-1$.

141. (1) $\int_0^{\pi} \frac{dx}{5+3\cos x}$

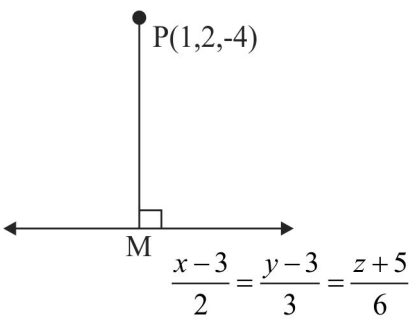
Put $\tan x/2 = t, \quad \therefore dx = \frac{2dt}{1+t^2}.$

$$= \int_0^{\infty} \frac{\frac{2dt}{1+t^2}}{5+3\left(\frac{1-t^2}{1+t^2}\right)} \quad x=0 \Rightarrow t=0 \quad As \quad x \to \pi, t \to \infty$$

$$= 2\int_0^{\infty} \frac{dt}{5+5t^2+3-3t^2} = 2\int_0^{\infty} \frac{dt}{8+2t^2}$$

$$= \frac{2}{2}\int_0^{\infty} \frac{dt}{t^2+4} = \frac{1}{2}\left[\tan^{-1}\left(\frac{t}{2}\right)\right]_0^{\infty} = \frac{1}{2}\left[\frac{\pi}{2}-0\right] = \frac{\pi}{4}$$

142. (2)



$$\frac{x-3}{2} = \frac{y-3}{3} = \frac{z+5}{6}$$

$m = (3+2\lambda, 3+3\lambda, -5+6\lambda)$

D.r.s of given line

2,3,6

Dr.s of PM are

$3+2\lambda-1, 3+3\lambda-2, -5+6\lambda+4$

$2\lambda+2,\ 3\lambda+1,\ 6\lambda-1$

Since PM is perpendicular to given line

$\therefore \quad 2(2\lambda+2)+3(3\lambda+1)+6(6\lambda-1)=0$

$\therefore \quad \lambda = \frac{-1}{49}$

$\therefore \quad M = \left(\frac{145}{49}, \frac{144}{49}, \frac{-251}{49}\right)$

$\therefore \quad PM = \frac{\sqrt{293}}{7}$

143. (3) "Mathematics is interesting" is not a propositoin.

144. (1) $f(x) = \begin{cases} \frac{1-\cos x}{x} & x \neq 0 \\ k & x = 0 \end{cases}$

$\lim_{x\to 0} \frac{1-\cos x}{x} (0/0\ form)$

Now by applying L-Hospital's rule we get

$\lim_{x\to 0} \frac{\sin x}{1} = 0 \quad \therefore k = 0$ for function to be continous.

145. (2) Volume $= v = \frac{4}{3}\pi r^3, \quad \frac{dv}{dt} = \frac{4}{3}\pi.3r^2\frac{dr}{dt}$

$$\Rightarrow \frac{dv}{dt} = 4\pi r^2.\frac{dr}{dt} \ at\ r = 7\ cm$$

$$35\ cc/\min = 4\pi(7)^2\frac{dr}{dt} \Rightarrow \frac{dr}{dt} = \frac{35}{4\pi(7)^2}$$

$S.A = 4\pi r^2$

$$\frac{ds}{dt} = 8\pi r\frac{dr}{dt} = \frac{8\pi.7.35}{4\pi(7)^2} = 10\ cm^2/\min$$

146. (4) n^{th} term of H.P. $= x_n = \frac{1}{a+(n-1)d}$

Here, $x_6 = \frac{1}{a+5d} = \frac{1}{61} \Rightarrow a+5d = 61$

$$x_{10} = \frac{1}{a+9d} = \frac{1}{105} \Rightarrow a+9d = 105$$

Solving we get $a = 6$, d =11

$\therefore$ First term = 1/a=1/6.

147. (1)

$$\sum_{k=1}^{6}\left[\sin\left(\frac{2\pi k}{7}\right)-i\cos\left(\frac{2\pi k}{7}\right)\right]$$

$$=-i\sum_{k=1}^{6}\left[\cos\frac{2\pi k}{7}+i\sin\frac{2\pi k}{7}\right]$$

$$=-i\sum_{k=1}^{6}e^{\frac{2\pi k}{7}i},\ \text{let } e^{\frac{2\pi}{7}i}=\alpha$$

$$=-i\left[\sum_{k=1}^{6}\alpha^{k}\right]$$

$$=-i\left[\alpha+\alpha^{2}+...+\alpha^{6}\right]$$

$$=-i\left[(1+\alpha+\alpha^{2}+...+\alpha^{6})-1\right]$$

$$=-i\left[\frac{1-\alpha^{7}}{1-\alpha}-1\right]=-i[0-1]$$

$$=i$$

148. (4)

Given that, maximize at $Z=11x+7y.$

From graph, the corner points of feasible solution are (0, 3), (0, 5) and (3, 2).

For point(0, 3): z = 0 + 7 × 3 = 21

For point(0, 3): z = 0 + 7 × 5 = 35

For point(0, 3): z = 11 × 3 + 7 × 2 = 47

So, maximum value of z occurs at (3, 2).

149. (3) Equation of one of line $y=(\tan 30°)x$

$$x-\sqrt{3}y=0$$

Equation of other line is

$$y=(\tan 60°)x$$

$\therefore\ \sqrt{3}x-y=0$

$\therefore$ Joint equation is $\sqrt{3}x^{2}-4xy+\sqrt{3}y^{2}=0$

150. (2)

$$\Delta=\begin{vmatrix}441 & 442 & 443\\ 445 & 446 & 447\\ 449 & 450 & 451\end{vmatrix}$$

$C_3\to C_3-C_2$

$$\Delta=\begin{vmatrix}441 & 442 & 1\\ 445 & 446 & 1\\ 449 & 450 & 1\end{vmatrix}$$

$C_2\to C_2-C_1$

$$\Delta=\begin{vmatrix}441 & 1 & 1\\ 445 & 1 & 1\\ 449 & 1 & 1\end{vmatrix}$$

Since C_2 & C_3 are identical

$\therefore\ \Delta=0$

151. (2)

Let $\begin{bmatrix}a & a\\ a & a\end{bmatrix}$ be the identity element then

$\begin{bmatrix}x & x\\ x & x\end{bmatrix}\begin{bmatrix}a & a\\ a & a\end{bmatrix}=\begin{bmatrix}x & x\\ x & x\end{bmatrix}$ i.e $2ax=x\Rightarrow a=1/2.$

Identity element = $\frac{1}{2}\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$.

152. (4) It makes zero intercept on x and y axis means the line passes through (0, 0)

The line is perpendicular to $3x+4y+6=0$

$\therefore$ Equation of the line $4x-3y+k=0$

$\therefore$ It passes through (0,0). $\therefore\ k=0.$

$\therefore$ The equation of the line is $4x-3y=0$.

153. (2) Given that,

$$\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}A=\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}$$

$$\Rightarrow\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}A=I$$

We know that, $AA^{-1}=I$

$$So,\quad A=\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}^{-1}$$

$$\text{Now,}\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}^{-1}=\frac{\text{adjoint of}\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}}{\begin{vmatrix}2 & 1\\ 3 & 2\end{vmatrix}}$$

Adjoint of

$$\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}=\begin{pmatrix}2 & -1\\ -3 & 2\end{pmatrix}and\begin{vmatrix}2 & 1\\ 3 & 2\end{vmatrix}=4-3=1$$

Therefore, $\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}^{-1}=\begin{pmatrix}2 & -1\\ -3 & 2\end{pmatrix}$

$$So,\quad A=\begin{pmatrix}2 & -1\\ -3 & 2\end{pmatrix}$$

154. (1)

$f(x)=4\sin^2 x+3\cos^2 x$

$f(x)=4\sin^2 x+3-3\sin^2 x$

$f(x)=\sin^2 x+3$

Since maximun of $\sin^2 x=1$

$\therefore$ Maximum value of $f(x)=1+3=4$

155. (4) $y=\tan^{-1}[\sec x-\tan x]$

$$y=\tan^{-1}\left[\frac{1}{\sec x+\tan x}\right]$$

$$y=\tan^{-1}\left[\frac{\cos x}{1+\sin x}\right]$$

$$y=\tan^{-1}\left[\frac{\cos\frac{x}{2}-\sin\frac{x}{2}}{\cos\frac{x}{2}+\sin\frac{x}{2}}\right]$$

$$y=\tan^{-1}\left[\left(\tan\frac{\pi}{4}-\frac{x}{2}\right)\right]$$

$$y=\frac{\pi}{4}-\frac{x}{2}$$

$$\frac{dy}{dx}=\frac{-1}{2}$$

156. (3) $p(t)=1000+\frac{1000t}{100+t^2}$

$$\Rightarrow p'(t)=\frac{2t^2(1000)-\left(100+t^2\right)(1000)}{\left(100+t^2\right)^2}$$

put $p'(t)=0$, we get t=10. Also

$p(t)=1050$ at $t=10$.

157.(3) $\int\frac{2dx}{\sqrt{1-4x^2}}=\int\frac{2dx}{\sqrt{1-(2x)^2}}=\sin^{-1}(2x)+C$

158. (3) Let the equation of the circle be

$x^2+y^2+2gx+2fy+C=0$ .....(i)

$\left(x_i,\frac{1}{x_i}\right)$ lies on (i).

$$\therefore x_i^2+\frac{1}{x_i^2}+2gx_i+2f.\frac{1}{x_i}+C=0$$

$$\therefore x_i^4+2gx_i^3+Cx_i^2+2fx_i+1=0$$

This is a fourth degree equation in x_i having $x_1,x_2,x_3\ and\ x_4$ are roots.

$\therefore x_1x_2\ x_3x_4$ = product of roots = 1/1 =1.

159. (1) $x^2-y^2=64\left(\sec^2\theta-\tan^2\theta\right)$

$\Rightarrow x^2-y^2=64 \quad ...(1)$

$\therefore$ (1) represents a rectangular hyperbola whose ecentricity = $\sqrt{2}$

$\therefore$ Distance between directries = $=\frac{2a}{e}=8\sqrt{2}$.

160. (2) Since $a*0=a+0-0=a$

also $0*a=a$ $\therefore 0$ is the identity element.

161. (3) Let position vectors of A,B,C ,D,M,N are $\bar{a},\bar{b},\bar{c},\bar{d},\bar{m},\bar{n}$

Here M & N are mid-points AC & BD

$$\therefore \quad \bar{m}=\frac{\bar{a}+\bar{c}}{2},\bar{n}=\frac{\bar{b}+\bar{d}}{2}$$

Now $\overline{AB}+\overline{AD}+\overline{CB}+\overline{CD}$

$$=\left(\bar{b}-\bar{a}\right)+\left(\bar{d}-\bar{a}\right)+\left(\bar{b}-\bar{c}\right)+\left(\bar{d}-\bar{c}\right)$$

$$=2\left(\bar{b}+\bar{d}\right)-2\left(\bar{a}+\bar{c}\right)$$

$$=2\left(2\bar{n}\right)-2\left(2\bar{m}\right)$$

$$=4\left(\bar{n}-\bar{m}\right)=4\overline{MN}$$

162. (1) $P\left(A'|B\right)=\frac{P\left(A'\cap B\right)}{P(B)}$

$$=\frac{P(B)-P\left(A\cap B\right)}{P(B)}=\frac{\frac{1}{2}-\frac{1}{6}}{\frac{1}{2}}=\frac{2}{3}$$

163. (2)

$R=\frac{abc}{4\Delta}$ *where* $\Delta=\sqrt{s\left(s-a\right)\left(s-b\right)\left(s-c\right)}$

$a=13,\ b=12, c=5, s=30/2=15$

$\Delta=\sqrt{15(2)(3)10}=3\times2\times5=30$

$\therefore R=\frac{13\times12\times5}{4\times30}=\frac{13}{2}$

164. (4) The equation of the parabola is

$$\left(x-1\right)^2+\left(y+1\right)^2=\frac{\left(x+y+7\right)^2}{2} \quad \therefore PS=PM.$$

or, $2\left(x^2+y^2-2x+2y+2\right)$

$$=x^2+y^2+49+2xy+14y+14x$$

or, $2x^2+2y^2-4x+4y+4$

$$=x^2+y^2+2xy+14x+14y+49$$

or, $=x^2+y^2-2xy-18x-10y-45=0.$

165. (3) Let A & B are two fixed points.

Given PA-PB = constant

$\therefore$ locus is hyperbola

166. (4) Let $\vec{A}=\hat{i}-\hat{j}+\hat{k},$ and $\vec{B}=2\hat{i}-3\hat{j}-\hat{k}$

$\therefore$ Unit Vector $=\frac{\vec{A}\times\vec{B}}{\left|\vec{A}\times\vec{B}\right|}$

$$=\frac{\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\1&-1&1\\2&3&-1\end{vmatrix}}{\left|\vec{A}\times\vec{B}\right|}=\frac{-2\hat{i}+3\hat{j}+5\hat{k}}{\sqrt{38}}$$

167. (4)

Given $n(A)=2$ & total relations from A to B = 1024

$\therefore\ 2^{n(A)n(B)}=1024$

$2^{2n(B)}=1024$

$2^{2n(B)}=2^{10}$

$n(B)=5$

168. (1) conceptul

169. (3) Let $I=\int_0^{\pi/2}\log(\tan x)dx$ (i)

Also $I=\int_0^{\pi/2}\log\tan(\frac{\pi}{2}-x)dx$

$I=\int_0^{\pi/2}\log\cot x\,dx$ (ii)

Adding (i) and (ii), we get

$2I=\int_0^{\pi/2}\log\tan x\,dx+\int_0^{\pi/2}\log\cot x\,dx$

$2I=\int_0^{\frac{\pi}{2}}\log(\tan x\cot x)$

$=\int_0^{\frac{\pi}{2}}\log(1)dx$

$2I=0\Rightarrow I=0$

170. (4) Let e be the identity element.

Then $a*e=a=a+e+7$

$\therefore(-7)^{-1}=e^{-1}=-7$

171. (2) $\{0,\pm2,\pm4,\pm6....\}$ is a group under addition as all the group postulates are satisfied

172. (1) $\underset{n\to\infty}{Lt}\left(3^n+4^n\right)^{\frac{1}{n}}=\underset{n\to\infty}{Lt}\left[4^1\left\{\left(\frac{3}{4}\right)^n+1\right\}\right]^{\frac{1}{n}}$

$\underset{n\to\infty}{Lt}\left(3^n+4^n\right)^{\frac{1}{n}}=4(0+1)=4$

$\left[\because\ \underset{n\to\infty}{Lt}\,r^n\to0\quad if\ r<1\right]$

173. (3) 4 odd digits in 4 even places can be arranged in 4! ways. But 2 alike (3, 3), 2 alike (5,5) are there.

$\therefore$ Number of ways $=\frac{4!}{2!2!}=\frac{24}{4}=6$ ....(i)

Remaining 5 even digits (2 alike, 3 alike) in 5 places can be arranged as above in

$\frac{5!}{2!3!}=\frac{120}{2X6}=10$ ways

By fundamental theorem total number $=6\times10$
$=60.$

174. (4)

Locus of point of intersection of perpendicular tangents to ellipse is direction circle.

For ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

Director circle is $x^2+y^2=a^2+b^2$

$\therefore$ For ellipse $\frac{x^2}{a}+\frac{y^2}{b}=1$

Director circle is

$x^2+y^2=9+4$

$x^2+y^2=13$

175. (4) Let $u=\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)=2\tan^{-1}x$

$v=\cot^{-1}\left(\frac{1-3x^2}{3x-x^3}\right)$

$=\tan^{-1}\left(\left(\frac{3x-x^3}{1-3x^2}\right)\right)=3\tan^{-1}x$

$\therefore\frac{du}{dv}=\frac{\frac{d}{dx}\left(2\tan^{-1}x\right)}{\frac{d}{dx}\left(3\tan^{-1}x\right)}=\frac{2\times\frac{1}{1+x^2}}{3\times\frac{1}{1+x^2}}=\frac{2}{3}$

176. (2) $\int\frac{dx}{\sqrt{2x-x^2}}=\int\frac{dx}{\sqrt{1-\left(x^2-2x+1\right)}}$

$$= \int \frac{dx}{\sqrt{1-(x-1)^2}} = \sin^{-1}(x-1) + C.$$

177. (1) Given that, function $f(x) = \cos^{-1}\sqrt{x-1}$

Domain of a function is a complete set of all possible inputs for the function.

We know that,

$$-1 \le \sqrt{x-1} \le 1$$

$$\Rightarrow 0 \le x-1 \le 1$$

$$\Rightarrow 0+1 \le x \le 1+1$$

$$\Rightarrow 1 \le x \le 2$$

So, domain of function $f(x)$ is $[1,2]$.

178. (2) For $\perp$ vectors $\vec{a}.\vec{b} = 0$

$$\therefore (\vec{a}+\lambda\vec{b}).(\vec{a}-\lambda\vec{b}) = 0$$

$$|\vec{a}|^2 - \lambda^2|\vec{b}|^2 + \lambda a.b - \lambda(\vec{a}.\vec{b}) = 0$$

$$a - \lambda^2 16 = 0$$

$$\lambda^2 = \frac{9}{16} \Rightarrow \lambda = \frac{3}{4}$$

179. (3) Equation of curve after squaring & adding

$$x^2 + y^2 = 9$$

$\therefore$ Equation of tangent at $\theta = \frac{\pi}{4}$

$$x\left(3\cos\frac{\pi}{4}\right) + y\left(3\sin\frac{\pi}{4}\right) = 9$$

$$\therefore \quad x + y = 3\sqrt{2}$$

180. (1) $\tan A + \cot A = 2$

$$\tan^2 A + 2 + \cot^2 A = 4$$

$$\tan^2 A + \cot^2 A = 2$$

Squaring

$$\tan^4 A + 2 + \cot^4 A = 4$$

$$\tan^4 A + \cot^4 A = 2$$

SUBJECT : BIOLOGY

181. (4) Canopy structure is an external factor that affects the rate of transpiration.

182. (1) Specialised cells in fixing nitrogen in Blue green algae/cyanobacteria are Heterocysts

183. (3) In the cell walls of chrysophytes silica is present which forms diatomaceous earth.

184. (1) At G1 DNA will be 2C , at the end of meiosis -I the DNA will be 2C as in S phase it had doubled followed by reduction division and Daughter nuclei at end of meiosis II will have 1C as there is no DNA replication in the interkinesis.

185. (4) Cytokinins promotes growth of new leaves, chloroplasts in leaves, lateral shoot growth and adventitious shoot formation

186. (3) Ethephon is ethylene and it is a ripening agent

187. (4) Use of bio resources by multinational companies and organisations without authorisation from the concerned country and it's people is called Biopiracy

188. (4) Volvox has a haplontic life cycle , therefore its zygote will undergo reduction to produce haploid spores.

189. (4) The statement can be corrected as Oospores and zygospores are diploid meiospores

190. (3) Cr-Jacob disease in humans is caused by Prions -infectious agent with abnormally folded protein

191. (1) A-III B-I C-II D-IV

192. (4) The statement can be corrected as Male cone and spirally arranged megasporophylls are borne on different tree in Cycas

193. (1) Protonema – Juvenile / vegetative phase of moss plant followed by leafy stage.

194. (1) If plant has 600 J of energy in plants , following the 10 % law , with each increase in

the trophic level , there is 10 % decrease, therefore peacock will have only 0.6% of energy.

195.(4) Glenoid cavity – is a part of the Shoulder girdle

196.(3) Thids is the correct combination.

(3) FRC ERV+RV 2300 mL

Functional residual capacity is the total of residual volume and expiratory reserve volume.

197.(2) Frog differs from man by having metamorphosis

198.(2) Descending limb of loop of henle is permeable to water and impermeable to salts.

199.(2) (a)-(ii); (b)-(i); (c)-(iii); (d)-(iv)

200.(3) Australian Marsupials are an example for Adaptive radiation.

201.(2) $Nt = N_0e^{rt}$. Where 'e' is base of natural logarithm

202.(4) The diagram represents stabilizing selection, 'A' – Peak gets higher and narrower Birth weight is a classic example, option 4 is wrong .

203.(1) (1)A-III, B-V, C-I, D-II, E-IV

204.(3) Osculum is an opening of Sponge, helps in outflow of water

205.(4) Myxine- hagfish is a cyclostome whose larvae metamorphosis in freshwater and adult forms are found in marine water.

206.(3) Struthio is ostrich , which is a flightless bird.

(3) Struthio a) Pneumatic bones
b) Well - developed flight muscles

207.(2) Acoelomate organism, generally parasitic in nature, absence of digestive system is characteristic of platyhelminthes - tapeworm.

208.(3) Epithelium in tubular part of nephron is mostly Cuboidal epithelium

209.(3) Blood is a fluid connective tissue having plasma as its matrix ,not containing fibres.

210.(4) Setae in earthworm serves for locomotion.

211.(1) In cockroach a series of segmentally arranged ganglia are joined by paired longitudinal connectives

212.(4) Teeth in man with 3 roots each are Molars

213.(4) Binding of oxygen with hemoglobin is primarily related to Partial pressure of O_2

214.(4) i – T, ii – F, iii – T, iv – T

215. (3) SA Node '! AV Node '! Bundle of His '! Purkinje fibers

216.(4) The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli. The cells of alveoli secrete milk, which is stored in the cavities (lumens) of alveoli.

217.(2) Hyperthyroidism / Graves diseaseshows the following symptoms protrusion of the eyeballs, increased basal metabolic rate , weight loss

218.(3) A population would grow exponentially if there were no limiting factors.

219.(2) The Scrubber is used mainly to remove SO_2 from the exhaust after spraying water/ lime

220.(4) Eco-friendly disposal of municipal solid-waste could be sorting the waste as biodegradable and non biodegradable and treating it separately , biodegradable will be broken down by micro-organisms and non-biodegradable can be treated according to the waste present.

221.(2) Insulin and TSH are protein hormones and will generate secondary messengers.

222.(2) Interferons are released in the body in response to virus.

223.(2) Biopiracy means using information/ technique of another company / country without their consent.

224.(4) To clone a gene of interest by PCR, we require

a) Primers b) dATP d) Taq polymerase

225.(4) Golden rice is Oryza sativa enriched with vitamin A using carotene gene using Agrobacterium.

226.(2) Option 2 is the correct palindromic sequence.

227.(2) There are 6 girdle bones - 2 scapula, 2 clavicle and pelvic bones , and there are 6 ear ossicles - 2 malleus , 2 incus, 2 stapes.

228.(2) In a sarcomere, only myosin filaments are present in H zone.

229.(2) Charas is obtained from Cannabis sativa.

230.(2) Tear and saliva are physiological barriers.

231.(3) Koala, banded anteater and Tasmanian tiger cat represent example of adaptive radiation

232.(2) Mammals directly evolved from therapsids

233.(2) Homo erectus has a cranial capacity of 900 cc.

234.(3) 350 million in 1947 and 1.2 billion in 2011.

235.(1) Multiload 375 is a IUD that prevents implantation and ovulation.

236.(4) By the fifth month, fetal movement and appearance of hair on head is observed.

237.(3) Secondary oocyte forms the zona pellucida.

238.(3) The ejaculatory duct opens into the prostatic urethra.

239.(2) During menstrual cycle gondatrophins attain a peak end of follicular phase leading to ovulation.

240.(3) IUI means intra uterine insemination, semen is introduced in the uterus when the sperm count is too low , leading to normal pregnancy and not requiring test tube baby technique.