

Date: 04/11/2018

Max. Marks: 100

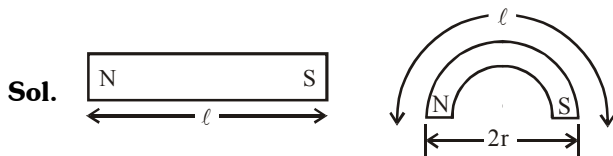
SOLUTIONS

Time allowed: 120 mins

1. A bar magnet of magnetic moment M is bent to form a semicircle. What is the magnetic moment of the bent magnet?

- (1) $\frac{M}{\pi}$ (2) $\frac{2M}{\pi}$ (3) $\frac{M\pi}{2}$ (4) M

Ans. (2)



Magnetic moment of a bar magnet of length ' l ' is

$$M = m_p \cdot l \quad \dots(1)$$

Where, m_p = pole strength

Now, when bar magnet is bent to form a semicircle of radius ' r ', its new magnetic moment will be

$$M' = m_p \cdot 2r \quad \dots(2)$$

$$\because l = \pi r \text{ (for semicircle)}$$

$$\therefore r = \frac{l}{\pi}$$

$$\text{So, } M' = m_p \cdot \frac{2l}{\pi}$$

$$\Rightarrow M' = \frac{2M}{\pi} \text{ (using equation (1))}$$

2. The SI unit of self-induction is

- (1) henry (2) $\frac{\text{weber}}{\text{ampere}}$ (3) $\frac{\text{volt} \times \text{sec}}{\text{ampere}}$ (4) All of the above

Ans. (1)

Sol. SI unit of self induction is 'Henry'.

$$\frac{\text{weber}}{\text{ampere}} \text{ and } \frac{\text{volt} \times \text{sec}}{\text{ampere}}$$

are also units of induction but these are not the SI units.

3. Critical angle for total internal reflection will be smallest for light travelling from :
 (1) Water to Glass (2) Glass to Water (3) Glass to Air (4) Water to Air

Ans. (3)

Sol. The relation between critical angle ' i_c ' and refractive index ' μ ' is

$$i_c = \sin^{-1} \left[\frac{1}{\mu} \right]$$

Thus, greater will be the refractive index, lesser will be the critical angle.

The combination 'Glass to Air' has greater refractive index comparatively, so value of critical angle will be smallest for it. Also, TIR is not possible for 'water to glass' combination here.

4. A lens behave as a covering lens in air and a diverging lens in water. The refractive index of lens is
 (1) 1 (2) 1.33 (3) Between unity and 1.33 (4) Greater than 1.33

Ans. (3)

Sol. Focal length of a lens can be given by lens maker formula as given below :

$$\frac{1}{f} = [\mu_{\text{rel}} - 1] \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

When lens is in air, it behaves as converging lens i.e. having positive focal length. This means

$$\mu_{\text{rel}} > 1$$

$$\left[\text{Where } \mu_{\text{rel}} = \frac{\mu_{\text{lens}}}{\mu_{\text{air}}}, \text{ with } \mu_{\text{air}} = 1 \right]$$

When lens is placed in water, it behaves as diverging lens. i.e., having focal length negative. That means

$$\mu_{\text{rel}} < 1$$

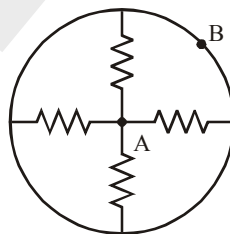
$$\Rightarrow \frac{\mu_{\text{lens}}}{\mu_{\text{water}}} < 1$$

$$\Rightarrow \mu_{\text{lens}} < \mu_{\text{water}}$$

$$\Rightarrow \mu_{\text{lens}} < 1.33$$

So, refractive index of lens is between 'unity' and '1.33'

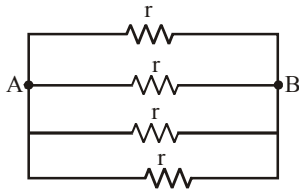
5. What is the equivalent resistance of the network between points A and B? (each resistance is of value r).



- (1) $\frac{r}{2}$ (2) $4r$ (3) $\frac{r}{4}$ (4) Zero

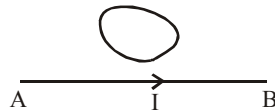
Ans. (3)

Sol. The network given can be reduced to following



So, $R_{AB} = \frac{r}{4}$

6. Current from A to B in the straight wire is decreasing. The direction of induced current in circular loop will be



- (1) Clock wise
- (2) Anticlock wise
- (3) No induced current flows
- (4) None of the above

Ans. (2)

Sol. Using right-hand thumb rule, law of electromagnetic induction and lenz law, it can be concluded that when current through wire AB is decreasing, the current in circular loop will induce in anticlockwise direction.

7. Dynamo works on the principle of

- (1) Heating effect of current
- (2) Electromagnetic induction
- (3) Chemical effect of current
- (4) Seebeck effect

Ans. (2)

Sol. Dynamo works on the principle of electromagnetic induction.

8. Lorentz force is given by : (symbols have their usual meanings)

- (1) $\vec{F} = q(\vec{E} + \vec{V} \times \vec{B})$
- (2) $\vec{F} = q(\vec{B} + \vec{V} \times \vec{E})$
- (3) $\vec{F} = q(\vec{E} - \vec{V} \times \vec{B})$
- (4) $\vec{F} = q(\vec{E} - \vec{V} \times \vec{B})$

Ans. (1)

Sol. Lorentz force.

$$\vec{F} = q(\vec{E} + \vec{V} \times \vec{B})$$

9. The radius of the path of a charged particle in a uniform magnetic field is directional proportional to

- (1) Charge of the particle
- (2) Momentum of the particle
- (3) Energy of the particle
- (4) Intensity of field

Ans. (2)

Sol. The magnetic force on a charge particle moving along a circular track in an external uniform magnetic field provides it necessary centripital force.

i.e., $\frac{mv^2}{r} = qvB$

$\Rightarrow r = \frac{mv}{qB} = \frac{P}{qB}$ (\because momentum of particle $P = mv$)

$\Rightarrow r \propto P$

10. A short sighted person uses a spectacle of power -0.4 D to see very distant objects. How far can he see without using spectacle?

- (1) 40 m (2) 100 m (3) 2.5 m (4) 10 m

Ans. (3)

Sol. Focal length of corrective lens

$$f = \frac{1}{P} = \frac{-1}{0.4} \Rightarrow f = -2.5\text{ m}$$

So, it is clear that the short sighted person can see upto 2.5 meter distance clearly, without use of the corrective lens.

11. Determine the potential difference between ends of a wire of resistance 5Ω if 720 C charge passes through it per minute.

- (1) 10 V (2) 20 V (3) 30 V (4) 60 V

Ans. (4)

Sol. Given, $R = 5\Omega$ and

$$I = \frac{q}{t} = \frac{720\text{C}}{1 \times 60\text{sec}}$$

$$\Rightarrow I = 12\text{ A}$$

Now, $V = IR$ (using ohm's law)

$$\Rightarrow V = 12 \times 5 = 60\text{ volts}$$

12. 15 cells each of emf 2 volt are connected in series but 2 of them are connected wrongly. Calculate the emf of the combination.

- (1) 30 volt (2) 26 volt (3) 22 volt (4) 28 volt

Ans. (3)

Sol. Given,

Each cell has emf of 2 volt.

15 cells are in series where 2 cells are connected in wrong polarity. The emf of 2 wrongly connected cells will be cancelled by the effect of other 2 cells' emf.

Thus, only 11 cells will be available to provide total emf of combination.

$$\therefore \text{Net EMF} = 11 \times 2\text{ volt} = 22\text{ volts}$$

13. Copper is

- (1) Paramagnetic (2) Diamagnetic (3) Ferromagnetic (4) None of these

Ans. (2)

Sol. Copper is a diamagnetic material.

14. Match the following

List - I

- (a) Frequency of distribution of the emitted radiation from a black body.
 (b) Spin quantum numbers (m_s)
 (c) Angular Momentum
 (d) All orbital have equal energy

Codes :

- | | |
|-----------|-------|
| (a) | (b) |
| (1) (iii) | (i) |
| (2) (ii) | (iii) |
| (3) (iii) | (iv) |
| (4) (iv) | (iii) |

List - II

- (i) degeneracy
 (ii) temperature dependent
 (iii) vector quantity
 (iv) mass time velocity times radius

- | | |
|------|------|
| (c) | (d) |
| (iv) | (ii) |
| (ii) | (i) |
| (ii) | (i) |
| (ii) | (i) |

Ans. (2)

Sol. Frequency of distribution of the emitted radiation from a black body is temperature dependent. Spin quantum numbers are vector quantity electrons revolve either clockwise or anticlockwise.

Angular momentum is related to mass times velocity times radius.

All orbitals have equal energy, so these are called degenerated.

15. Maximum co-valency of phosphorous can be

- (1) 4 (2) 5 (3) 6 (4) 3

Ans. (2)

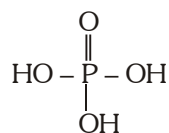
Sol. Phosphorus has maximum covalency 5.

16. Nucleic acids are called acids mainly because of the presence of

- (1) -COOH group (2) -OH group in the sugar unit
(3) -OH group of the heterocyclic base (4) -OH group of the phosphate unit

Ans. (4)

Sol. Nucleic acid has phosphoric acid group



Phosphoric acid

17. 0.225 g of an organic dibasic acid required 100 ml of 0.05N NaOH solution to complete the neutralization. The molecular mass of the acid will be

- (1) 180 (2) 90 (3) 45 (4) 120

Ans. (2)

Sol. Basicity of Dibasic acid = 2

as acid is completely neutralised by NaOH.

i.e. normality of acid = normality of base.

$$\text{molarity of dibasic acid} = \frac{\text{normality of acid}}{\text{Basicity of acid}} = \frac{0.05}{2} = 0.025 \text{ M}$$

$$\text{molarity of acid} = \frac{\text{mass of acid} \times 1000}{\text{molecular mass} \times \text{volume}}$$

$$\text{molecular mass of acid} = \frac{\text{mass of acid} \times 1000}{\text{molarity of acid} \times \text{volume}}$$

$$= \frac{0.225 \times 1000}{0.025 \times 100}$$

molecular mass of acid = 90

18. In a reaction the initial concentration of the reactants increase fourfold and rate become eight times its initial value. The order of reaction is

- (1) 2.0 (2) 1.0 (3) 2.5 (4) 1.5

Ans. (4)

Sol. Case - I = R = K [A]^M ..(1)
Case - II = 8R = K [4A]^M ... (2)

On putting the value of R in equation (2)

$$8K[A]^M = K [4A]^M.$$

$$8[A]^M = 4[A]^M.$$

$$8[A]^M = 4^M[A]^M$$

$$8 = 4^M$$

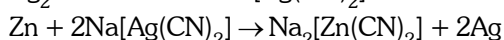
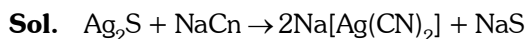
$$2^3 = 2^{2M}$$

$$3 = 2M$$

$$M = 1.5$$

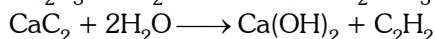
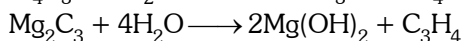
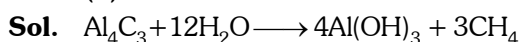
- 19.** Silver is extracted from Ag₂S by
- (1) fusion it with KCl and electrolyzing the melt
 - (2) reducing it with Zinc
 - (3) treating with sodium cyanide followed by Zinc
 - (4) roasting it and reducing the resultant product by smelting.

Ans. (3)



- 20.** Al₄C₃, Mg₂C₃ and CaC₂ are separately treated with water. The organic products formed respectively are
- (1) methane, ethane and acetylene
 - (2) methane methylacetylene and acetylene
 - (3) methylacetylene, methylacetylene and acetylene
 - (4) methane, methylacetylene and methane

Ans. (2)



- 21.** Fog is a colloidal solution of
- (1) liquid particles dispersed in gas
 - (2) gaseous particles dispersed in a liquid
 - (3) solid particles dispersed in a liquid
 - (4) solid particles dispersed in a gas

Ans. (1)

Sol. Fog is aerosol in which liquid dispersed in gas.

- 22.** What is the approximate characteristic voltage that develop across a red LED?

- (1) 3.4 V
- (2) 1.7 V
- (3) 0.9 V
- (4) 1.9 V

Ans. (4)

Sol. Approximate characteristic voltage of red LED is 1.9V.

- 23.** In which of the following pairs, the second compound is more polar than the first?

- (1) (CH₃)CCl and CH₄
- (2) CHCl₃ and CCl₃F
- (3) CH₃NH₂ and CH₃NO₂
- (4) CH₃OH and CH₃NH₂

Ans. (3)

Sol. CH₃-NH₂ → +I effect.

CH₃-NO₂ → -I effect.

- 24.** The alloy nichrome contains
- (1) Ni, Cr, Fe and Mn
 - (2) Cr, Ni, Cu and Zn
 - (3) Ni, Cr, Fe and Zn
 - (4) Ni, Cr, Fe and C

Ans. (1)

Sol. Nichrome contains Ni, Cr, Fe and Mn.

25. Which of the following pairs have layer lattice structure in solid state chemistry?
 (1) SrCl₂ and CdI₂ (2) Diamond and graphite
 (3) Graphite and CdI₂ (4) MgSO₄ · 7H₂O and FeSO₄ · 7H₂O

Ans. (3)

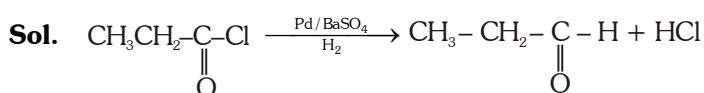
Sol. Graphite and CdI₂ have layered structure.

26. In the reaction $\text{CH}_3\text{CH}_2\text{COCl} \xrightarrow[\text{H}_2]{\text{Pb/BaSO}_4} \text{X}$

the X is

- (1) propionaldehyde (2) acetaldehyde (3) acetic acid (4) acetone

Ans. (1)



propionaldehyde

27. Each of the following molecule is a polymer except
 (1) Protein (2) Cellulose (3) Glucose (4) Glycogen

Ans. (3)

Sol. Glucose is a monomer/organic compound, considered as simple sugar/monosaccharide. While protein is formed by multiple amino acids linked through peptide bond, cellulose & glycogen are formed by various glucose unit.

28. In a population of 500 rats, there were 55 births and 05 (five) deaths during one year period. What is the reproductive rate of the population during one year period.
 (1) 0.01/yr. (2) 0.05/yr (3) 0.1/yr. (4) 5.5/yr

Ans. (3)

Sol.
$$\text{Reproductive rate} = \frac{\text{Birth} - \text{death}}{\text{population size}} = \frac{55 - 5}{500} = \frac{50}{500} = 0.1/\text{yr}$$

29. Movement of molecules during diffusion can be described as all of the following except -
 (1) Each molecule moves randomly.
 (2) Solute molecules always moves down the concentration gradient
 (3) Each molecule moves independently of other molecule
 (4) Net movement of solute molecules is from region of higher to region of lower concentration

Ans. (1)

Sol. During diffusion movement of molecules occurs from its higher concentration to its lower concentration not randomly.

30. Plasma membrane consists mainly of :
 (1) Protein embedded in carbohydrate
 (2) Phospholipids embedded in protein bilayer
 (3) Protein embedded in phospholipid bilayer
 (4) Protein embedded with polymer of glucose

Ans. (3)

Sol. Plasma membrane consists of protein embedded in phospholipid bilayer.

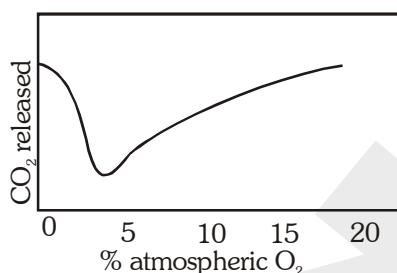
31. Which one of the following expresses concept of allele in a lucid way-

- (1) Genes for wrinkled and yellow seeds.
- (2) Genes for wrinkled and round seeds.
- (3) Dominant expression of wrinkled genes.
- (4) All of the above

Ans. (2)

Sol. An allele is an alternative form of a gene that is located at a specific position on a specific chromosome. Pair of allelic character for shape of seed is round (dominant allele) & wrinkled (recessive allele)

32. Above graph shows amount of CO_2 produced by plant cells at various levels of atmospheric O_2 . In respiration at atmospheric oxygen below 1% level the amount of CO_2 released is relatively high. This is due to



- (1) TCA cycle is hyper active.
- (2) There is insufficient amount of CO-enzyme A
- (3) Alcoholic fermentation is occurring.
- (4) Pyruvic acid oxidation is incomplete.

Ans. (3)

Sol. During alcoholic fermentation pyruvic acid is broken into ethyl alcohol and CO_2 . Thus at atmospheric oxygen below 1% level the amount of CO_2 released is relatively high as plant cells undergo anaerobic respiration.

33. All of the following statements about the process of cell divisions are true except one, mark it.

- (1) Spindle fibres are made of microtubules.
- (2) All eukaryotic cells possess centriole.
- (3) Many of the microtubules are attached to the centromere of the chromosomes.
- (4) Centriole consists of nine triplets of microtubules arranged in a circle.

Ans. (2)

Sol. All eukaryotic cells do not possess centrioles. They are present in all animal cells and only in lower plant forms.

34. During the process of respiration, all of the following processes release CO_2 except -

- (1) Conversion of pyruvate to ethanol.
- (2) Oxidative Phosphorylation.
- (3) Tricarboxylic acid cycle.
- (4) Conversion of pyruvic acid to Acetyl CoA

Ans. (2)

Sol. The electron transport system leads to the formation of ATP from ADP and inorganic phosphate. This generation of ATP is called oxidative phosphorylation.

35. In typical cell divisions by mitosis and meiosis, all of the following contributes to genetic variation except:

- (1) Anaphase of meiosis
- (2) Random fusion of egg and sperm
- (3) Crossing over (exchange of Genes)
- (4) Anaphase of mitosis

Ans. (4)

Sol. Mitosis gives rise to genetically identical cells in which the chromosome number is maintained.

36. One of the following statements is true about photosynthetic pigments in plants.

- (1) There is only one type of chlorophyll.
- (2) Chlorophyll absorbs only green light during photosynthesis.
- (3) Chlorophyll is found in the membrane of Thylakoids.
- (4) Chlorophyll is needed for Calvin cycle.

Ans. (3)

Sol. Chlorophyll is found in membrane of thylakoid of chloroplast.

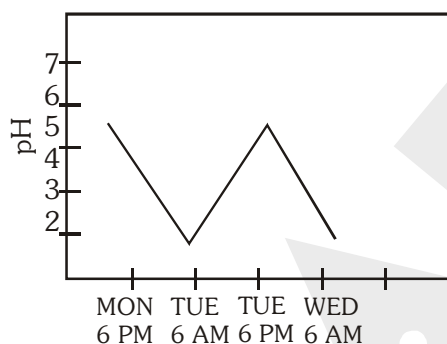
37. When the concentration of solutes differs on the two sides of a membrane permeable only to water, then -

- (1) Water will move across the membrane by active transport.
- (2) Water will move across by the process of Osmosis.
- (3) Water will move across through plasmolysis.
- (4) Water will move across by diffusion.

Ans. (2)

Sol. Osmosis is movement of solvent (water) from region of its higher concentration to region of its lower concentration through a semi permeable membrane.

38. Graph represents the measurement of pH in plant leaves during 36 hrs. of photosynthetic activity. It indicates that acid products were being :

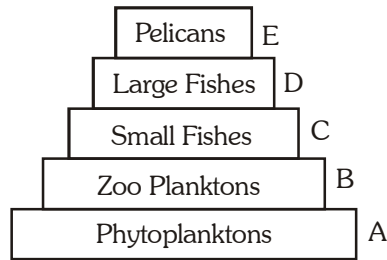


- (1) Produced at night.
- (2) Produced during the day.
- (3) Produced at night and degraded during the day.
- (4) Produced during the day and degraded at night.

Ans. (3)

Sol. As shown in the graph pH reduces from 6PM to 6AM due to accumulation of acidic products like CO_2 at night and pH rises from 6 AM to 6 PM showing degradation of products formed.

39. Figure shows pyramid of biomass at different trophic levels. At which trophic level, would the biological magnification of DDT would be highest.



- (1) At A & C (2) At A only (3) At A & B (4) At E only

Ans. (4)

Sol. Biological magnification is progressive increase in concentration of harmful non-biodegradable chemical like DDT at different trophic levels in a food chain.

40. When deciduous trees drops their leaves during fall, the colour of leaves turn to various shades of red, orange and yellow due to the presence of :

- (1) Chlorophyll A & B (2) Presence of Fungal growth
(3) Presence of Carotenoids (4) Insufficient ATP

Ans. (3)

Sol. Chlorophyll breaks down, green colour disappear and at the same time other orange and red pigments develop.

41. A positive integer n when divided by 9, gives 7 as remainder. What will be the remainder when $(3n - 1)$ is divided by 9?

- (1) 1 (2) 2 (3) 3 (4) 4

Ans. (2)

Sol. Given a positive integer n is divided by 9 gives 7 as the remainder.

Let a be quotient.

$$n = 9a + 7$$

$$3n - 1 = 3(9a + 7) - 1$$

$$= 27a + 20 \Rightarrow 27a + 18 + 2$$

$$\Rightarrow 9(3a + 6) + 2$$

when divided by 9 remainder will be 2.

42. If the zeros of the polynomial $x^3 - 3x^2 + x + 1$ are $(a - d)$, a and $(a + d)$ then $(a + d)$ is :

- (1) a rational number (2) an integer (3) a natural number (4) an irrational number

Ans. (4)

Sol. Given $P(x) = x^3 - 3x^2 + x + 1$

zeros are $(a + d)$, a , $(a - d)$

$$\text{Sum of zeros} = a + d + a + a - d = -(-3)$$

$$3a = 3$$

$$a = 1$$

$$\text{Product of zeros} = (a + d)(a)(a - d) = -1$$

$$\Rightarrow (a^2 - d^2)a = -1$$

$$\Rightarrow (1 - d^2)(1) = -1 \quad (\because a = 1)$$

$$\Rightarrow 2 = d^2$$

$$\Rightarrow d = \pm\sqrt{2}$$

43. If the product of the roots of the equation $x^2 - 2\sqrt{2} Kx + 2e^{2\log k} - 1 = 0$ is 31, then the roots of the equations are real for K equal to

- (1) 4 (2) 3 (3) 2 (4) 1

Ans. (1)

Sol. $x^2 - 2\sqrt{2} Kx + 2e^{2\log k} - 1 = 0$

$= x^2 - 2\sqrt{2} Kx + 2k^2 - 1 = 0$

α, β are two zeros of equation

Product of zeros ($\alpha\beta$) = 31

$\Rightarrow 2k^2 - 1 = 31$

$\Rightarrow 2k^2 = 32$

$\Rightarrow k^2 = 16$

$k = \pm 4$

but $k = -4$ is not possible

$\therefore k = 4$

44. The solution of $\log \frac{x}{\sqrt{3}} + \log \frac{x}{\sqrt[4]{3}} + \log \frac{x}{\sqrt[9]{3}} + \dots + \log \frac{x}{\sqrt[16]{3}} = 36$. Find x

- (1) $x = 3$ (2) $x = \sqrt{3}$ (3) $x = 4\sqrt{3}$ (4) $x = 9$

Ans. (2)

Sol. $\log \frac{x}{\sqrt{3}} + \log \frac{x}{\sqrt[4]{3}} + \log \frac{x}{\sqrt[9]{3}} + \dots + \log \frac{x}{\sqrt[16]{3}} = 36$

$\Rightarrow 2\log_3 x + 4\log_3 x + \dots + 16\log_3 x = 36$ ($\log_{\sqrt[m]{a}} x = m\log_a x$)

$\Rightarrow \log_3 x (2 + 4 + \dots + 16) = 36$

$\Rightarrow \log_3 x (72) = 36$

$\Rightarrow \log_3 x = \frac{1}{2}$ [by definition]

$\Rightarrow x = 3^{\frac{1}{2}}$

$\Rightarrow x = \sqrt{3}$

45. A certain number of tennis balls were purchased for Rs. 450. Five more balls could have been purchased for the same amount if each ball was cheap by Rs. 15. The number of balls purchased is

- (1) 15 (2) 20 (3) 25 (4) 10

Ans. (4)

Sol. Let the number of balls purchased be x

$$\text{ATQ, } \frac{450}{x} - \frac{450}{x+5} = 15$$

$$450 \left(\frac{1}{x} - \frac{1}{x+5} \right) = 15$$

$$\frac{\cancel{x} + 5 - \cancel{x}}{x(x+5)} = \frac{15}{450}$$

$$\frac{5}{x^2 + 5x} = \frac{1}{30}$$

$$x^2 + 5x - 150 = 0$$

$$(x + 15)(x - 10) = 0$$

$$\therefore x - 10 = 0$$

$$\Rightarrow x = 10$$

46. If $S_n = nP + \frac{n}{2}(n-1)Q$, where S_n denotes the sum of the first n terms of an Arithmetic Progression (A.P), then the common difference is

(1) $P + Q$

(2) $2P + 3Q$

(3) $2Q$

(4) Q

Ans. (4)

Sol. $S_n = nP + \frac{n}{2}(n-1)Q$

$$= nP + \frac{n^2Q}{2} - \frac{nQ}{2}$$

$$= n \left(P - \frac{Q}{2} \right) + \frac{n^2Q}{2}$$

Using $S_n = An^2 + Bn$

$$A = \frac{Q}{2}$$

$$B = P - \frac{Q}{2}$$

$$\therefore d = 2A = 2 \times \frac{Q}{2} = Q$$

$$\Rightarrow d = Q$$

47. The value of $\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \sin \frac{7\pi}{14} \sin \frac{9\pi}{14} \sin \frac{11\pi}{14} \sin \frac{13\pi}{14}$ is

(1) $\frac{1}{16}$

(2) $\frac{1}{64}$

(3) $\frac{1}{128}$

(4) None of these

Ans. (2)

Sol. $\sin \frac{13\pi}{14} = \sin\left(\pi - \frac{\pi}{14}\right) = \sin \frac{\pi}{14}$
 $\sin \frac{11\pi}{14} = \sin\left(\pi - \frac{3\pi}{14}\right) = \sin \frac{3\pi}{14}$
 $\sin \frac{9\pi}{14} = \sin\left(\pi - \frac{5\pi}{14}\right) = \sin \frac{5\pi}{14}$
 $\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \sin \frac{7\pi}{14} \sin \frac{9\pi}{14} \sin \frac{11\pi}{14} \sin \frac{13\pi}{14}$
 $\sin^2 \frac{\pi}{14} \sin^2 \frac{3\pi}{14} \sin^2 \frac{5\pi}{14}$
 $\sin\left(\frac{\pi}{14}\right) = \sin\left(\frac{\pi}{2} - \frac{6\pi}{14}\right) = \cos \frac{6\pi}{14}$
 $\sin\left(\frac{3\pi}{14}\right) = \sin\left(\frac{\pi}{2} - \frac{4\pi}{14}\right) = \cos \frac{4\pi}{14}$
 $\sin\left(\frac{5\pi}{14}\right) = \sin\left(\frac{\pi}{2} - \frac{2\pi}{14}\right) = \cos \frac{2\pi}{14}$
 $\left(\cos \frac{2\pi}{14} \cdot \cos \frac{4\pi}{14} \cdot \cos \frac{6\pi}{14}\right)^2$

Now,

$$\cos \frac{6\pi}{14} = \cos\left(\pi - \frac{8\pi}{14}\right) = -\cos \frac{8\pi}{14}$$

$$\left(-\cos \frac{2\pi}{14} \cdot \cos \frac{4\pi}{14} \cdot \cos \frac{8\pi}{14}\right)^2$$

$$(\cos\theta \cdot \cos 2\theta \cdot \cos 2^2\theta)^2$$

$$= \left(\frac{\sin \frac{16\pi}{14}}{2^3 \sin \frac{2\pi}{14}}\right)^2 = \frac{1}{64}$$

- 48.** If a flagstaff of 6 meters high placed on the top of a tower throws a shadow of $2\sqrt{3}$ metres along the ground then, the angle (in degrees) that the sun makes with the ground is
 (1) 60° (2) 30° (3) 45° (4) None of these

Ans. (1)

Sol. Given,

height of tower = 6 m

shadow of tower is = $2\sqrt{3}$

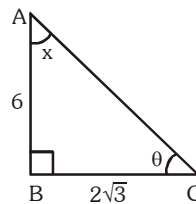
$$\tan \theta = \frac{AB}{BC}$$

$$\tan \theta = \frac{6}{2\sqrt{3}}$$

$$\tan \theta = \sqrt{3}$$

$$\tan \theta = \tan 60^\circ$$

$$\theta = 60^\circ$$



49. Which one of the following decimal expansion is not terminating?

- (1) $\frac{3}{8}$ (2) $\frac{6}{15}$ (3) $\frac{17}{512}$ (4) $\frac{29}{343}$

Ans. (4)

Sol. $\frac{29}{343}$

For terminating, denominator must be in the form of $2^n \times 5^m$.

50. If $\cos \theta + \cos^2 \theta = 1$ then $\sin^4 \theta + \sin^2 \theta = \dots\dots$

- (1) 0 (2) 1 (3) $\frac{1}{2}$ (4) None of these

Ans. (2)

Sol. If $\cos \theta + \cos^2 \theta = 1$, then $\sin^4 \theta + \sin^2 \theta$

We can write

$$\cos \theta = 1 - \cos^2 \theta \quad \dots(1)$$

$$\therefore \sin^4 \theta + \sin^2 \theta$$

$$\sin^2 \theta (\sin^2 \theta + 1)$$

$$(1 - \cos^2 \theta) \{1 - \cos^2 \theta + 1\} \quad [\because 1 - \cos^2 \theta = \sin^2 \theta]$$

$$\cos \theta (\cos \theta + 1) \quad [\text{from equation (1)}]$$

$$\cos^2 \theta + \cos \theta = 1 \quad \text{H.P.}$$

51. A and B are fixed point. The vertex C of ΔABC moves such that $\cot A + \cot B = \text{constant}$. The locus of C is

- (1) A straight line perpendicular to AB (2) A straight line parallel to AB
 (3) Inclined at an angle $(A - B)$ to AB (4) None of these

Ans. (2)

Sol. Let the coordinate of C(h, k)

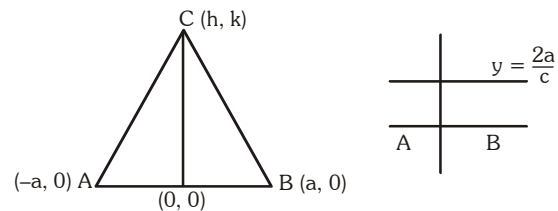
$$\cot A = \frac{h+a}{k}$$

$$\cot B = \frac{a-h}{k}$$

$$\frac{h+a}{k} + \frac{a-h}{k} = \text{constant (given)}$$

$$\frac{2a}{k} = c$$

$$k = \frac{2a}{c}$$



52. The distance of the point (3, 5) from the line $2x + 3y - 14 = 0$ measured parallel to the line $x - 2y = 1$ is

- (1) $\frac{7}{\sqrt{5}}$ (2) $\frac{7}{\sqrt{13}}$ (3) $\sqrt{5}$ (4) $\sqrt{13}$

Ans. (3)

Sol. Slope of $2x + 3y - 14 = 0$ is $-\frac{2}{3}$

$$\text{distance} = \left| \frac{2 \times 3 + 3 \times 5 - 14}{\sqrt{3^2 + 2^2}} \right| \Rightarrow \left| \frac{6 + 15 - 14}{\sqrt{14}} \right| \Rightarrow \frac{7}{\sqrt{14}}$$

$$\tan \theta = \frac{\frac{1}{2} + \frac{2}{3}}{1 - \frac{1}{3}} = \frac{\frac{3+4}{6}}{\frac{2}{3}} \Rightarrow \frac{7}{4}$$

$$\therefore \sin \theta = \frac{d}{h} = \frac{7}{7^2 + 4^2} = \frac{7}{\sqrt{65}}$$

$$\Rightarrow h = \frac{\sqrt{65}}{7} \times \frac{7}{\sqrt{13}} = h = \sqrt{5}$$

53. Three horses are tethered with 7 metre long ropes at the three corner at a triangle field having sides 20 m, 34 m and 42 m. The area of the plot when can be grazed by horses is

- (1) 50 m^2 (2) 77 m^2 (3) 82 m^2 (4) 90 m^2

Ans. (2)

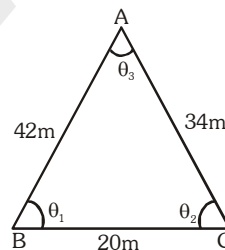
Sol. The area of 3 horses (taking grazed corners in a triangle) = 3 sectors of a circle radius (r) = 7 cm

Let the three angles be θ_1, θ_2 and θ_3

$$\text{Now, } \frac{\pi r^2 \theta_1}{360^\circ} + \frac{\pi r^2 \theta_2}{360^\circ} + \frac{\pi r^2 \theta_3}{360^\circ}$$

$$\Rightarrow \frac{\pi}{360^\circ} 7 \times 7 (\theta_1 + \theta_2 + \theta_3) \text{ [by angle sum property]}$$

$$\Rightarrow \frac{22}{7} \times \frac{7 \times 7}{360^\circ} \times 180^\circ = 77 \text{ m}^2$$



54. The mean of 25 observations is 36. If the mean of the first 13 observations is 32 and that of the last 13 observations is 39 then the 13th observation is

- (1) 32 (2) 30 (3) 28 (4) 23

Ans. (4)

Sol. The mean of 25 observation is 36

$$x = \frac{\text{sum}}{n}$$

$$\text{Sum} = 36 \times 25 = 900 \quad \dots(1)$$

If the mean of the first 13 observations is 32.

$$\text{Sum} = 13 \times 32 = 416 \quad \dots(2)$$

and that of last 13 observation is 39

$$\text{again, Sum} = 13 \times 39 = 507 \quad \dots(3)$$

equation (2) + (3)

$$13 \times 32 + 13 \times 39 = 13 (32 + 39) = 13 \times 71 = 923 \quad \dots(4)$$

13th observation = equation (4) – (1)

$$923 - 900 = 23$$

then the 13th observation is 23.

55. A right circular cone is 8.4 cm high and the radius of its base is 2.1 cm . The cone is melted and recast into a sphere. Find the radius of the sphere.

- (1) 2.1 cm (2) 4.2 cm (3) 5.3 cm (4) 6.4 cm

Ans. (1)

Sol. Given,

height of cone (h) = 8.4 cm

radius (r) = 2.1 cm

Let the radius of sphere be = R cm

Volume of cone = volume of sphere

$$\frac{1}{3} \pi r^2 h = \frac{4}{3} \pi R^3$$

$$(2.1)^2 \times 8.4 = 4 R^3$$

$$(2.1)^2 \times 2.1 \times 4 = 4 R^3$$

$$\Rightarrow R^3 = (2.1)^3$$

$$R = 2.1 \text{ cm}$$

56. The average weight of pupils of a class is 46 Kg. The average weights of boys and girls are respectively 50 Kg and 40 Kg. The ratio of the number of boys to the number of girls is

- (1) 2 : 3 (2) 3 : 2 (3) 2 : 5 (4) 5 : 2

Ans. (2)

Sol. Let the number of boys x and number of girls y

$$\therefore \frac{50x + 40y}{x + y} = 46$$

$$50x + 40y = 46x + 46y$$

$$4x = 6y$$

$$\frac{x}{y} = \frac{6}{4}$$

$$x : y = 3 : 2$$

Hence, the number of boys to the number of girls is 3 : 2

- 57.** The internal and external diameters of a hollow hemispherical vessel are 24 cm and 25 cm respectively. If the cost for painting 1 cm² of the surface area is Rs. 0.05 then the total cost of painting the vessel all over is
 (1) Rs. 90.05 (2) Rs. 96.28 (3) Rs. 95.20 (4) Rs. 96.29

Ans. (4)

Sol. Let the external radius and internal radius are R and r. Total surface area to be painted =

External curved surface area + internal surface area + area of ring

$$2\pi R^2 + 2\pi r^2 + \pi R^2 - \pi r^2$$

$$\Rightarrow \pi (3R^2 + r^2)$$

$$\Rightarrow \frac{22}{7} (3 \times 12.5 \times 12.5 + 12 \times 12)$$

$$\Rightarrow \frac{22}{7} (468.75 + 144)$$

$$\Rightarrow \frac{22}{7} \times 612.75$$

$$\Rightarrow 1925.78 \text{ cm}^2$$

Rate of painting = 5 Paisa / cm²

$$\text{₹} \frac{1925.78 \times 5}{100} = \text{₹}96.29$$

- 58.** If each edge of a cube is increased by 50% then the percentage increase in its surface area is
 (1) 50% (2) 125% (3) 130% (4) 140%

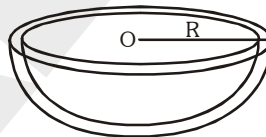
Ans. (2)

Sol. Let each edge of cube be 'a' then, area of cube = 6a²

each edge of cube increase by 50%

$$\text{New edge} = a + a \times \frac{50}{100} \Rightarrow \frac{3a}{2}$$

$$\text{New area of cube} = 6 \left(\frac{3a}{2} \right)^2 \Rightarrow \frac{9}{4} (6a^2)$$

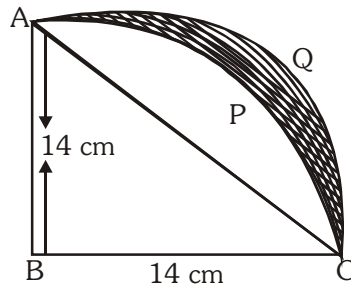


then, the area increased (percentage)

$$= \frac{\frac{9}{4}(6a^2) - 6a^2}{6a^2} \times 100$$

$$= \left(\frac{9}{4} - 1 \right) \times 100 \Rightarrow \frac{5}{4} \times 100 = 125\%$$

59. In the adjoining figure ABCPA is a quadrant of a circle of radius 14 cm. With AC as diameter, a semicircle is drawn. The area of the shaded region is



- (1) 35 cm^2 (2) 64 cm^2 (3) 98 cm^2 (4) 132 cm^2

Ans. (3)

Sol. AC is a diameter

\therefore in $\triangle ABC$ is a right triangle by pythagoras

$$AC^2 = AB^2 + BC^2$$

$$AC^2 = (14)^2 + (14)^2$$

$$AC^2 = 2(196)$$

$$AC = 14\sqrt{2} \text{ cm}$$

then, radius $(r) = 7\sqrt{2} \text{ cm}$

Area of semicircle AQC

$$= \frac{1}{2} \times \text{area of circle}$$

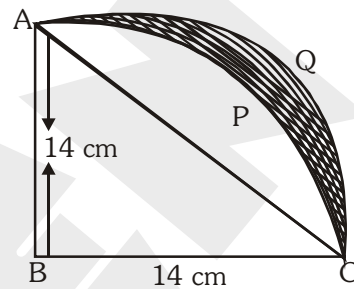
$$= \frac{1}{2} \times \pi r^2$$

$$= \frac{1}{2} \times \frac{22}{7} (7\sqrt{2})^2$$

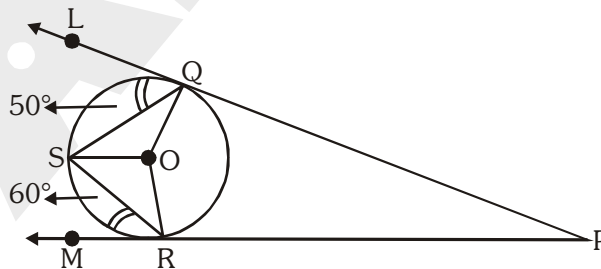
$$= \frac{1}{2} \times \frac{22}{7} \times 7\sqrt{2} \times 7\sqrt{2} = 154 \text{ cm}^2$$

Area of shaded region = area of semicircle AQC – area of quad. ABQP – ar. of $\triangle ABC$

$$= 154 - (154 - 98) = 98 \text{ cm}^2$$



60. In the adjoining figure, O is the centre of a circle; PQL and PRM are the tangents at the points Q and R respectively and S is a point on the circle such that $\angle SQL = 50^\circ$ and $\angle SRM = 60^\circ$ then the value of $\angle QSR$ is



- (1) 40° (2) 50° (3) 60° (4) 70°

Ans. (4)

Sol. Join QR

$$\angle SRM = \angle SQR = 60^\circ \text{ [Alternate segment theorem]}$$

$$\text{and } \angle SQL = \angle SRS = 50^\circ \text{ [}\therefore \text{ Alternate segment theorem]}$$

Now, in $\angle SQR$

$$\angle S + \angle Q + \angle R = 180^\circ$$

$$\angle S + 60^\circ + 50^\circ = 180^\circ$$

$$\angle S = 180^\circ - 110^\circ$$

$$\angle QSR = 70^\circ$$

61. Who of the following founded young Italy?

- (1) Mazzini (2) Garibaldi (3) Cavour (4) None of these

Ans. (1)

Sol. Mazzini founded 'Young Italy' and 'Young Europe'.

62. Napoleon Bonaparte is credited to awaken one of these for obtaining unity

- (1) Austria (2) Russia (3) Serbia (4) Italy

Ans. (3)

Sol. Napoleon is credited to Serbia for obtaining unity.

63. Vladimir Ilyich Ulyanov was the full name of

- (1) Leon Trotsky (2) Nikolai Lenin (3) Joseph Stalin (4) Nicholas II

Ans. (2)

Sol. Vladimir Ilyich Ulyanov was the full name of Nikolai Lenin.

64. Who of the following rulers reigned Russia during 1894 to 1917?

- (1) Nicholas I (2) Nicholas II (3) Catherine (4) Alexander I

Ans. (2)

Sol. Tsar Nicholas II rules Russia during 1894 to 1917.

65. On of the following was not associated with the name of Lenin

- (1) He brought about radical changes in education
(2) He gave high honour to church
(3) He introduced New Economic Policy with the help of Capitalists
(4) He attacked slavery

Ans. (2)

Sol. He did not give honour to church

66. The political idea that is based on the belief that all people are money and property should be equally divided is known as

- (1) Communism (2) Socialism (3) Post Modernism (4) Oligarchism

Ans. (2)

Sol. Socialism based on the idea that all people are equal and that money and property should be equally divided.

67. The Pint French Governor General of Indo-China who administered it between 1897 - 1902 was

- (1) Paul Doumer (2) Albert Sarraut (3) Louis De Frcycinct (4) Ngo Dinh Diem

Ans. (1)

Sol. The first french governor general of Indo-China was Paul Doumer (1897 - 1902)

68. Against which of the following Great Britain and France declared War on 3rd Sept, 1939?

- (1) Japan (2) Italy (3) Germany (4) Russia

Ans. (3)

Sol. Britain and France declared War against Italy on 3rd Sept, 1939.

69. In January 1942 Japan defeated _____ army and captured Philippines island.
(1) American (2) French (3) English (4) All the three

Ans. (1)

Sol. In January 1942 Japan defeated American Army.

70. Which of these statement is incorrect ?
(1) The system of Secret Alliances developed after the Franco Prussian War of 1870.
(2) The First World War was not the product of rising nationalist sentiment.
(3) Italy was throughout with Germany in the First World War.
(4) USA supported England and France in the First World War.

Ans. (2)

Sol. That was a product of rising nationalist sentiment.

71. The Khilafat Movement started in 1919 was against the British Government maltreatment towards
(1) Turkey (2) Iran (3) Iraq (4) Saudi Arabia

Ans. (1)

Sol. Khilafat Movement started in 1919 due to wrong done by British against Turkey.

72. One of these is not a labour leader.
(1) S.A. Dange (2) Gopen Chakrabarti
(3) Sohan Singh Josh (4) Kshitindra Mohan Sen

Ans. (1)

Sol. S.A. Dange was a founding member of government party in India.

73. Which of the following have been recognised on World Network of Biosphere Reserves by UNESCO ?
I. Sunderbans
II. Niligiri
III. Kanchanzanga
IV. Gulf of Mannar
(1) I, II and III (2) II, III and IV (3) I, III and IV (4) I, II, III and IV

Ans. (4)

Sol. Sunderbans, Niligiri, Kanchanzanga, Gulf of Mannar are world net work of biosphere reserves by UNESCO.

74. Which of the following is/are correct about shifting cultivation ?
I. It is also called 'Jhoom' in Assam.
II. It is a 'Slash and burn' agriculture,
III. It involves crop rotation.
IV. It involves transhumance.
(1) I, II, III and IV (2) II, III and IV (3) I and II only (4) II and III only

Ans. (3)

Sol. Shifting cultivation is known 'Jhoom' in Assam. And is also known as Slash and burn agriculture.

75. Which of the following ports are located on the eastern coast of India ?
(1) Cochin, Goa, Mumbai (2) Mumbai, Kolkata, Chennai
(3) Paradeep, Kakinada, Nagapattinam (4) Machilipatnam, Kandla, Aleppey

Ans. (3)

Sol. Paradeep, Kakinada, Nagapattinam located on Eastern coast of India.

76. The Indian Meteorological Department declares a day as rainy day after having how much of rainfall on such day ?
(1) 0.50 mm to 1.00 mm in 24 hours (2) 1.10 mm to 1.50 mm in 24 hours
(3) 1.60 mm to 2.00 mm in 24 hours (4) Above 2.5 mm in 24 hours

Ans. (4)

Sol. Above 2.5 mm in 24 hours declared as rainy day by IMD

77. Which of the following are the tributaries of Brahmaputra river ?

- I. Dibang II. Kameng III. Lohit
(1) I and II (2) II and III (3) I and III (4) I, II and III

Ans. (3)

Sol. Dibang and Lohit are tributaries of Brahmaputra river.

78. Nanda Devi Biosphere is situated state of

- (1) Nagaland (2) Arunachal Pradesh (3) Uttarakhand (4) Tripura

Ans. (3)

Sol. Nanda Devi Biosphere is situated state in Uttarakhand

79. Which of the following is not correct about the cultivation of coffee in India ?

- I. It is cultivated in the tropical highlands.
II. It grows well on the laterite soils of Karnataka and Tamil Nadu.
III. It stands first as a popular beverage in India.
IV. Coffee Cultivation are generally done on less than 10 hectares land area.
(1) I and II (2) III and IV (3) only II (4) only III

Ans. (4)

Sol. It grows well on the laterite soil of Karnataka and Tamil Nadu.

80. Which of the following states of India have tropical moist evergreen forest ?

- I. Arunachal Pradesh
II. Himachal Pradesh
III. Mizoram
(1) I and II (2) II and III (3) I and III (4) None of these

Ans. (3)

Sol. Arunachal Pradesh, Mizoram, Kerala have tropical moist evergreen forest.

81. Identify Kharif crops by wing the codes of the following crops.

- I. Cotton II. Groundnut III. Maize iv. Mustard
(1) I and II (2) I, II and III (3) III and IV (4) All of the above

Ans. (4)

Sol. Cotton, Groundnut, Maize, Mustard, rice are major kharif crops.

82. If the local time at Patna, located at 85°E longitude is 10:00 hour then what will be the local time at Chennai located at 80°E longitude and Jodhpur located at 73°E Longitude ?

- (1) 09:12 hour, 09:40 hour (2) 09:40 hour, 09:12 hour
(3) 10:40 hour, 10:12 hour (4) 10:12 hour, 10:40 hour

Ans. (2)

Sol. 09:40 hour, 09:12 hour

83. Which of the following statements are true with regard to Coal in India ?

- I. Coal is found in Sedimentary rocks.
II. The best quality of coal is lignite.
III. Damodar river valley is popular known as "Ruhr of India".
(1) I and II (2) II and III (3) I and III (4) I, II and III

Ans. (3)

Sol. Coal is found in Sedimentary rocks & Damodar river valley is popular known as "Ruhr of India".

84. Which state of India is famous for Jute Textile Industry ?

- (1) Tripura (2) Assam (3) Bihar (4) West Bengal

Ans. (4)

Sol. West Bengal is famous for Jute textile Industry.

85. Nonsharing of powers in a democracy leads to

- I. Peace among all the communities
- II. The tyranny of the majority
- III. Oppression of minorities
- IV. Political stability in the country

(1) I and II (2) II and III (3) I and IV (4) III and IV

Ans. (2)

Sol. Nonsharing of power in democracy leads to tyranny of the majority and oppression of minority.

86. Which of the following only be removed by impeachment?

- I. The President
- II. The Prime Minister
- III. The Speaker of the Lok Sabha
- IV. The Vice-President

(1) I and II (2) II and III (3) III and IV (4) I and IV

Ans. (4)

Sol. President and Vice President only be removed by impeachment.

87. Which of the following are 3rd tier of government in India?

- I. Community Government
- II. State Government
- III. Panchayat Raj Government
- IV. Urban Local Bodies

(1) I and IV (2) II and III (3) III and IV (4) I and II

Ans. (3)

Sol. Panchayati Raj Government and Urban local bodies are third tier of government in India.

88. Which of the following are the features of Federal Government?

- I. Two or multi levels of government
- II. Single Citizenship
- III. Independent Judiciary
- IV. Fusion of Legislature and Executive

(1) I and II (2) I and III (3) II and IV (4) III and IV

Ans. (2)

Sol. Federal government is two or multilevel of government and has independent judiciary.

89. Writs can be issued by

- I. The Supreme Court
- II. The High Courts
- III. The District Courts
- IV. The Parliament

(1) I and II (2) II and III (3) I and IV (4) III and IV

Ans. (1)

Sol. Supreme Court and High Court issues writs.

90. Which of the following are fundamental rights ?

- I. Right to Education
- II. Right to Life
- III. Right to Property
- IV. Right to information

(1) I and II (2) III and IV (3) II and III (4) I and IV

Ans. (1)

Sol. Right to education and right to life are fundamental right.

91. Which type of party system exists in India ?

- I. One-party system
- II. Bi-Party system
- III. Multi party system
- IV. Partyless system

- (1) I and II (2) II and III (3) III and IV (4) only III

Ans. (4)

Sol. India has multi party system more than one political parties are there.

92. In a democracy, the term 'Fourth Pillar' is used for :

- I. The Parliament
- II. The Executive
- III. The Judiciary
- IV. The Media

- (1) I and II (2) III and IV (3) only IV (4) II and III

Ans. (3)

Sol. In a democracy the term 'fourth pillar' is used for media.

93. Which of the following statements are correct ?

Statement I : Integration of market in different countries is known as foreign trade.

Statement II: Investment made by MNCs is called foreign investment.

Statement III ; Rapid improvement information and communication technology has been one of the major factor that has stimulated globalization process.

Statement IV : All above statements are correct.

- (1) Only I is correct (2) Only I and III are correct
(3) Statement IV is correct (4) Only II and III is correct

Ans. (4)

Sol. d

94. Which of the following activities can be included in the primary sector ?

- (1) Giving Joans to the farmer (2) Making oil from sunflower
(3) Cultivating sunflower (4) Providing storage facility for the grains

Ans. (3)

Sol. Cultivation of sun flower is indude in primary sector.

95. Globalization was not stimulated by -

- I. Money
- II. Transport
- III. Population
- IV. Computer

- (1) Only I is correct (2) Only I and II are correct
(3) I, III and IV are correct (4) III and IV are correct

Ans. (N/A)

Sol. Population and computer stimulate globalisation.

96. In the market place, consumers are exploited when

- (1) Shopkeepers weighs less than they should
(2) Traders add charges thai were not mentioned before
(3) Adullered / Defective goods are sold
(4) All of the above

Ans. (4)

Sol. Consumers are exploited by weighs less, adulterated goods and changes high.

97. What does food security mean?

- (1) Availability of food
- (2) Accessibility of food
- (3) Availability and accessibility of food to all at all the time
- (4) Availability, accessibility and affordability of food to all at all the time

Ans. (4)

Sol. Availability, access and affordability of food to all at all the time.

98. Which of the following types of activities are covered in the secondary sector ?

- (1) It generates services rather than goods
- (2) Natural products are changed through manufacturing
- (3) Goods are produced by exploiting natural resources
- (4) It includes agriculture, forestry and dairy

Ans. (2)

Sol. Natural products are changed through manufacturing.

99. Which of the following organization looks after the credit needs of agriculture and rural development in India ?

- (1) FCI
- (2) IDBI
- (3) NABARD
- (4) ICAR

Ans. (3)

Sol. NABARD

100. The minimum guaranteed price at the government offer to purchase from farmers is known as -

- (1) Procurement price
- (2) Minimum support price
- (3) Issue Price
- (4) Market Price

Ans. (2)

Sol. Minimum support price is a pre announced price by the government to protect farmer
