

Date: 14/02/2021

Max. Marks: 100

SOLUTIONS

Time allowed: 120 mins

1. A taxonomist during his voyage found a solitary marine animal with spines on skin made of calcium carbonate. However, its coelom was made of pouches pinched off from endoderm. Assign the specimen to the most appropriate Phylum.

- (1) Chordata (2) Nematoda (3) Coelenterata (4) Echinodermata

Ans. (4)

Sol. Echinodermates are exclusively marine benthic animals with dermal spines made up of calcium carbonate. Echinodermates have enterocoelom i.e. coelom derived from endodermal pouch that pinch off from archenteron.

2. An individual with genotype AaBbCcddEe is crossed with another individual with genotype AabbCcDdEe. Assuming Mendelian pattern of inheritance, predict the proportion of aabbccdde among the progeny of this cross?

- (1) 1/32 (2) 1/64 (3) 1/128 (4) 1/256

Ans. (4)

Sol. In such genetic cross each gene is crossed separately and then probability of desired progeny is obtained by multiplying the probability of each gene as shown below

Aa × Aa	Bb × bb	Cc × Cc	dd × Dd	Ee × Ee
Aa Aa Aa aa	Bb Bb bb bb	CC Cc Cc cc	Dd dd Dd dd	EE Ee Ee ee

Probability of aa = $\frac{1}{4}$, bb = $\frac{2}{4}$, cc = $\frac{1}{4}$, dd = $\frac{2}{4}$, ee = $\frac{1}{4}$

So probability of aabbccdde is

$$\frac{1}{4} \times \frac{2}{4} \times \frac{1}{4} \times \frac{2}{4} \times \frac{1}{4} = \frac{1}{256}$$

3. Which one of the four methods of propagation is likely to lead to maximum variation in DNA sequence through generations?

- (1) Budding in *Hydra* (2) Binary fission in *Amoeba*
(3) Reproduction in human beings (4) Vegetative propagation of sugarcane

Ans. (3)

Sol. Sexual reproduction involves two parents and crossing over during gamete formation via meiosis also produces variations. Whereas budding, binary fission and vegetative propagation are methods of asexual reproduction in which offsprings are genetically similar to parent.

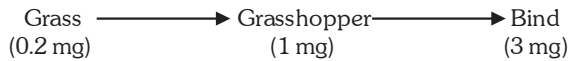
4. A case of bio-magnification was being studied. A laboratory received equal quantities of three sample M, N and O. The levels of pesticides found in these samples are as follows: M-1 mg, N-0.2 mg, O-3 mg.

The sample M, N and O respectively could be :

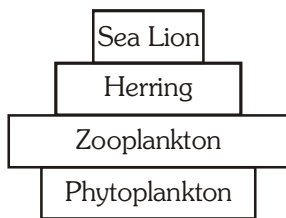
- (1) Grass, grasshoppers and adipose tissue of birds (2) Grasshoppers, grass and adipose tissue of birds
 (3) Grass, adipose tissue of birds and grasshoppers (4) Adipose tissue of birds, grasshoppers and grass

Ans. (2)

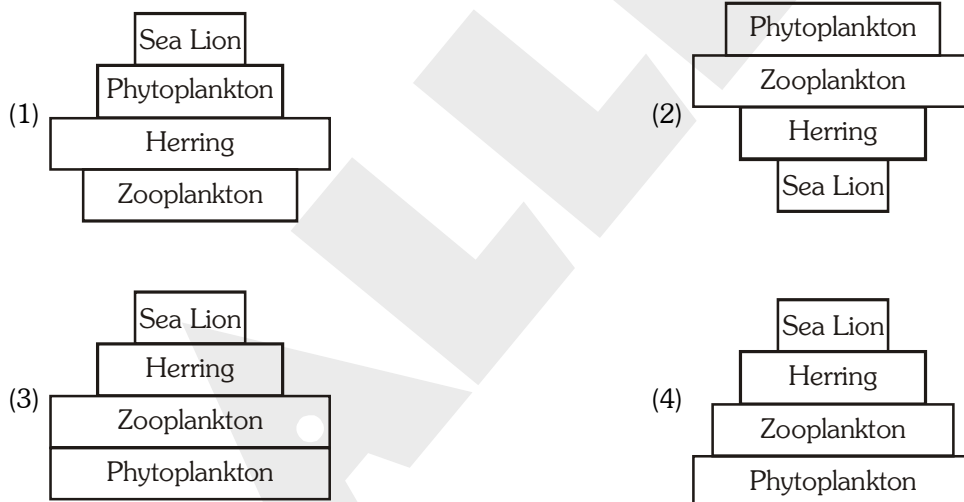
Sol. Biomagnification is gradual increase in concentration of non-biodegradable substance with increasing trophic level of food chain. In given food chain, maximum concentration would be in birds.



5. Illustration of a pyramid of number of an aquatic ecosystem is given.



The pyramid of energy for the same ecosystem would be :



Ans. (4)

Sol. Energy flow in any ecosystem is always unidirectional and upright as according to 10% law of energy flow, 90% energy used in maintaining the trophic level only 10% of energy available at any trophic level is available for next trophic level.

6. Which of the following traits would an evolutionary biologist consider to understand the divergent evolution process?
- (1) Hind limb of sheep, flipper of whale and wing of a bat
 - (2) Flipper of shark, flipper of penguin and flipper of dolphin
 - (3) Bat wing, bird wing and wing of a butterfly
 - (4) Human arm, seal forelimb and wing of a bird

Ans. (4)

Sol. Homologous organs evident common ancestry and divergent evolution. Forelimbs of vertebrates have common origin but adapted to do different functions. Human arm, seal forelimb and wings of a bird are homologous organs that evident divergent evolution.

7. In adjacent agricultural lands of nearly equal dimensions, two farmers A and B had cultivated crops of their choice and observed standard practices. A pathogen attacked the crops and destroyed it in the land belonging to farmer A, as a result of which he suffered complete loss. Although the pathogen attacked the adjacent land belonging to farmer B, he was able to earn some money by selling the yield. The possible explanation for the above is–
- (1) Farmer A must have cultivated only one crop whereas Farmer B must have cultivated two crops.
 - (2) Farmers A and B must have cultivated the same crop with a fence between the two agricultural lands.
 - (3) Farmer A over irrigated the crop due to which it attracted the pathogen
 - (4) Farmer B removed weeds from the cultivated land.

Ans. (1)

Sol. Practice of growing two or more crops simultaneously (mixed cropping) reduces risk of crop failure. Though pathogen attacked crops of farmer A and B both but farmer B must have cultivated more than one crop. As pathogens (pest) are crop specific that's why farmer B could harvest other crop.

8. A biology teacher placed a hen's egg in three different solutions:

Solution A : Pure water

Solution B : Saturated salt solution,

Solution C : Hydrochloric acid

The sequence of treatments and the ensuing probable effect on the egg and listed below :

I. A → B → C → Remains unchanged

II. B → C → A → Swells

III. C → A → B → Shrinks

IV. B → A → C → Loses salts

Based on the above sequence of treatment which one of the option will be correct?

(1) I and II

(2) I and IV

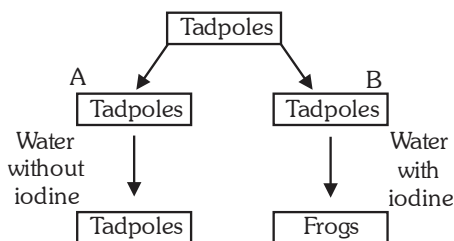
(3) II and III

(4) III and IV

Ans. (3)

Sol. When an egg is placed in HCl, it becomes deshelled and when this deshelled egg is placed in Hypotonic solution it swells whereas in Hypertonic solution it shrinks.

9. Observe the flow chart below.



Which of the following best explains the observed results?

- (1) Iodine helps to produce thyroxine
- (2) Iodine inhibits thyroid gland activity
- (3) Absence of iodine leads to starvation
- (4) Iodine promotes cell growth and division

Ans. (1)

Sol. Iodine is required for formation thyroxine which is required for conversion of tadpole larva into adult.

10. An experiment conducted in the laboratory is tabulated below.

Test tube-A	Test tube-B	Test tube-C
Saliva + Iodine ↓ <i>incubation</i>	Starch + Saliva ↓ <i>incubation</i>	Starch + Saliva + Enzyme inhibitor ↓ <i>incubation</i> + Iodine

What would be the color observed in test tubes A, B and C at the end of the experiment?

- (1) A-Yellow, B-No color, C-Blue black
- (2) A-No color B-Blue black, C-Yellow
- (3) A-Blue black, B-Yellow, C-No color
- (4) A-No color, B-Yellow, C-Blue black

Ans. (1)

Sol. In test tube A, No starch is there so it shows yellow color of iodine.

In test tube B, starch reacts with salivary amylase and form Maltose and no color will be observed.

In test tube C, starch reacts with iodine to give blue black color.

Saliva enzyme (Salivary amylase) are not able to digest starch due to presence of enzyme inhibitor.

11. The presence of a specific molecule (called markers) in an organelle can be used to identify the presence of that organelle. A researcher has three test tubes with organelles A, B and C, each of which shows the presence of one marker as shown below :

Organelle	Marker	Function of the marker
A	Cytochrome oxidase	Involved in ATP synthesis
B	Ribosomal RNA	Part of ribosome
C	Acid hydrolyase	Degrades different molecules

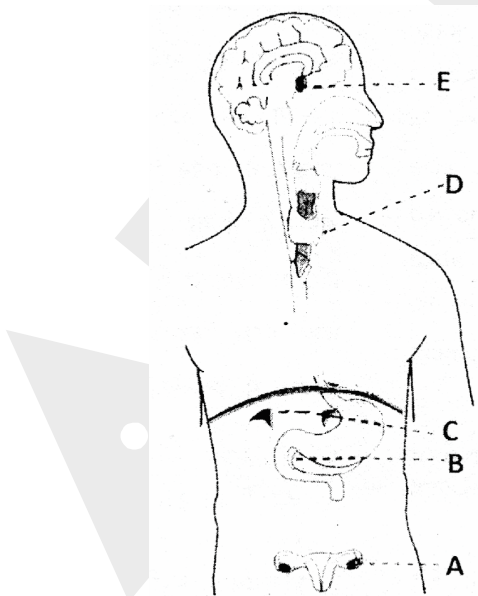
Based on the information given in the table, identify the organelles A, B and C

- (1) A : Plastids; B : Rough Endoplasmic Reticulum (RER); C : Lysosomes
 (2) A : Mitochondria; B : RER; C : Lysosomes
 (3) A : Mitochondria; B : Smooth Endoplasmic Reticulum (SER); C : Golgi apparatus
 (4) A ; Plastids; B : SER; C : Golgi apparatus

Ans. (2)

Sol. Cytochrome oxidase is present in mitochondria. Ribosomal RNA is part of ribosome which are found attached to RER and Acid Hydrolases are digestive enzyme present in lysosome.

12. Positions of endocrine glands are labeled A – E in the given diagram. Match the symbols of glands in column 1 with the type of hormone it secretes given in column 2.



Column 1	Column 2	
A	I.	Progesterone
B	II.	Insulin
C	III.	Parathyroid hormone
D	IV.	Melatonin
E	V.	Follicle stimulating hormone
	VI.	Thyroxine
	VII.	Aldosterone

Choose the correct combination from the following:

(1) A-I, B-II, C-VII, D-III, E-V

(2) A-I, B-IV, C-II, D-III, E-VI

(3) A-V, B-II, C-IV, D-III, E-VII

(4) A-V, B-IV, C-VII, D-III, E-II

Ans. (1)

Sol. A is Ovary which releases Progesterone.

B is Pancreas which releases Insulin.

C is Adrenal gland which releases Aldosterone.

D considering Parathyroid releases Parathyroid hormone.

E is Pituitary which release F.S.H.(Follicle stimulating hormone)

13. Virulent forms of the bacterium *Staphylococcus aureus* is a human pathogen, some strains of which cause “flesh-eating disease”. Earlier the antibiotic Penicillin was used to control this pathogen. After some years Penicillin was ineffective. Hence, a powerful antibiotic-Methicillin was used in treatments. Subsequently, Methicillin also became ineffective and the strains showed resistance to multiple antibiotics also called “multi-drug resistance”. Which one of the following statements regarding development of multi-drug resistance is correct?

(1) Antibiotics led to mutation in the DNA of bacterium thus creating drug resistant strains

(2) Antibiotics helped in the selection for bacterium with mutations in the DNA conferring drug resistance which were already present in the population

(3) Even without the use of antibiotics the drug resistant strains would have evolved at the rate as observed in the above situation

(4) Presence of antibiotics induces changes in the metabolism of the bacterium leading to drug resistance.

Ans. (2)

Sol. Variation are always present in the population and they get selected in specific environment. Antibiotic resistance is consequence of evolution via natural selection. The antibiotic action is an environmental pressure; those bacteria which have a mutation allowing them to survive will live on to reproduce. They will then pass this trait to their offspring, which will be a fully resistant generation.

14. 1.80 of glucose ($C_6H_{12}O_6$) was dissolved in 36 g water. The number of oxygen atoms in solution are:
(1) 6.68×10^{23} (2) 12.40×10^{22} (3) 6.68×10^{22} (4) 12.40×10^{23}

Ans. (4)

Sol. Moles of glucose = $\frac{1.80}{180} = 0.01$ mole

Mole of water = $\frac{36}{18} = 2$ mole

Total number of O-atoms = Number of O-atoms in glucose + No. of O-atoms in water
= $0.01 \times 6 \times N_A + 2 \times 1 \times N_A$
= $2.06 N_A$
= $2.06 \times 6.023 \times 10^{23}$ atoms
= 12.40×10^{23} atoms

15. Consider the following statements:

- (I) F, Cl, N and O are electronegative elements.
(II) Electrons in the atoms given in statement I are in K and L shell only.
(III) Tendency of forming cations decreases in second period of periodic table upto F.

Correct statement(s) is/are

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

Ans. (3)

Sol. (I) F, Cl, N and O are electronegative elements.

(III) Tendency of forming cations decreases in second period of periodic table upto F, because of their electronegativity.

16. Let T = Temperature, H = Humidity and v = Wind speed.

Which of the following are the best suited conditions for drying up of clothes ?

- (1) T = 40°C, H = 10%, v = 45 m/s (2) T = 28°C, H = 20%, v = 35 m/s
(3) T = 20°C, H = 30%, v = 25 m/s (4) T = 15°C, H = 40%, v = 15 m/s

Ans. (1)

Sol. Rate of Evaporation \propto Temperature

Rate of Evaporation \propto Wind speed

Rate of Evaporation $\propto \frac{1}{\text{Humidity}}$

17. 100 mL of solution containing 0.1 mole of NaOH per litre was mixed with 100 mL solution containing 0.02 mole of H_2SO_4 per litre. The amount of NaOH in the mixture in grams will be:

- (1) 0.12 (2) 0.24 (3) 2.4 (4) 0.36

Ans. (2)

Sol. Milliequivalents of NaOH = $0.1 \times 100 \times 1 = 10$

Milliequivalents of $\text{H}_2\text{SO}_4 = 0.02 \times 100 \times 2 = 4$

After neutralisation remaining milliequivalents of NaOH = $10 - 4 = 6$

Number of equivalents = 6×10^{-3}

Number of equivalents = $\frac{\text{Mass}}{\text{equivalent mass}}$

Then mass = $6 \times 10^{-3} \times 40 = 24 \times 10^{-2}$

Then amount of NaOH will be = 0.24 gm

18. On oxidation with alkaline KMnO_4 followed by acidification of the reaction mixture, which one of the following alcohols would produce an acid having three structural isomers ?

- (1) Propanol (2) Butanol (3) Pentanol (4) Hexanol

Ans. (1)

Sol. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH} \xrightarrow{\text{Alkaline KMnO}_4} \text{CH}_3\text{-CH}_2\text{-COOH}$

Propanol

Propanoic acid

3 isomers will be formed

(i) $\text{CH}_3\text{-CH}_2\text{-COOH}$ (Propanoic acid)

(ii) $\text{CH}_3\text{-}\overset{\text{O}}{\parallel}\text{C}\text{-O-CH}_3$ (methyl ethanoate)

(iii) $\text{H-}\overset{\text{O}}{\parallel}\text{C}\text{-O-CH}_2\text{-CH}_3$ (Ethyl methanoate)

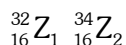
19. Atomic number of an element Z is 16. Element Z has two isotopes Z_1 and Z_2 with 16 and 18 neutrons respectively. The average atomic mass of a sample of the element Z is 32.1 u. Which one of the following percentages of Z_1 and Z_2 in the sample is correct ?

- | Z_1 | Z_2 |
|---------|-------|
| (1) 95% | 5% |
| (2) 94% | 6% |
| (3) 93% | 7% |
| (4) 92% | 8% |

Ans. (1)

Sol. Atomic number of Z is 16.

Two isotopes with 16 and 18 neutrons.



$$\text{Average atomic mass} = \frac{32 \times x + 34(100 - x)}{100}$$

$$32.1 = \frac{32x + 3400 - 34x}{100}$$

$$3210 = 32x + 3400 - 34x$$

$$3210 - 3400 = -2x$$

$$-190 = -2x$$

$$Z_1 = x = 95\%$$

$$Z_2 = 100 - x = 5\%$$

20. Detergents are also called surface active agents (surfactants). These have two distinct parts: one hydrophilic spherical part and another hydrophobic long tail made of carbons chain. Two experiments 'A' and 'B' were carried out. In experiment 'A', surfactant was added in a beaker containing water. In experiment 'B', surfactant was added in a beaker containing hexane.

Following are possible results in these experiments:

- (I) In experiment 'A' (see figure 'a') micelle is formed, where hydrophobic part is inside the micelle and hydrophilic part is outside the micelle.
- (II) In experiment 'B' (see figure 'b') micelle of reverse type is formed where hydrophilic part is inside the micelle and hydrophobic part is outside the micelle.
- (III) Micelle of reverse type is formed in experiment 'A'.
- (IV) Micelles are large enough to scatter light in 'A'.

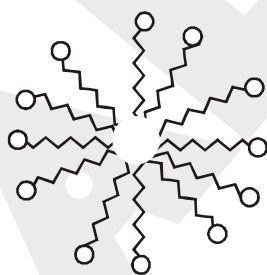


Figure 'a'

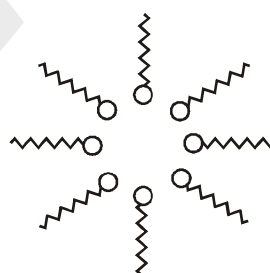


Figure 'b'

Correct observations are:

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

Ans. (2)

Sol. Statement I, II and IV are correct.

(I) In statement 'A' micelle is formed in which hydrophobic part is inside the micelle and hydrophilic part is outside the micelle.

(II) In experiment 'B' reverse micelle is formed in which hydrophilic part is inside the micelle and hydrophobic part is outside the micelle.

(IV) Micelles are colloidal solutions, so they scatter light.

21. Reaction of organic compound 'A' with 'B' in acidic condition gives compound 'C'. Compound 'B' reacts with alkaline KMnO_4 solution and gives compound 'A'. Compound 'C' gives compound 'B' as one of the product when reacted with sodium hydroxide solution. Which of the following statement is/are correct.

(I) 'A' is CH_3COOH

(II) 'B' is $\text{CH}_3\text{CH}_2\text{OH}$

(III) 'C' is $\text{CH}_3\text{COOCH}_2\text{CH}_3$

(IV) 'A' is sweet smelling substance

(1) I and II only

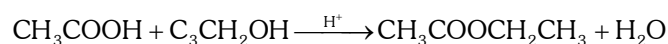
(2) I, II and III only

(3) I, III and IV only

(4) III and IV only

Ans. (2)

Sol. Esterification reaction.



'A' is CH_3COOH

'B' is $\text{CH}_3\text{CH}_2\text{OH}$

'C' is $\text{CH}_3\text{COOC}_2\text{H}_5$ (Fruity smell)

22. Equal volumes of solutions containing 1 mole of an acid and 1 mole of a base respectively are mixed. Which of these mixture will give pH more than 7 ?

(1) Sodium hydroxide + Acetic acid

(2) Potassium hydroxide + Sulphuric acid

(3) Ammonium hydroxide + Sulphuric acid

(4) Sodium hydroxide + Hydrochloric acid

Ans. (1)

Sol. Solution containing NaOH and acetic acid will have pH more than 7 because in this solution base is strong and acid is weak. Resulting solution will be basic.

23. A part of the modern periodic table is shown below in which elements have been represented by English letters of the alphabets.

Group → Period ↓	1	2	13	14	15	16	17
1	A						
2	B			H		J	K
3	C	E					
4	D	F					M
5	N						

On the basis of the above periodic table, which one of the following statements is incorrect ?

(1) M will have -1 valency

(2) C will form an ionic compound with K

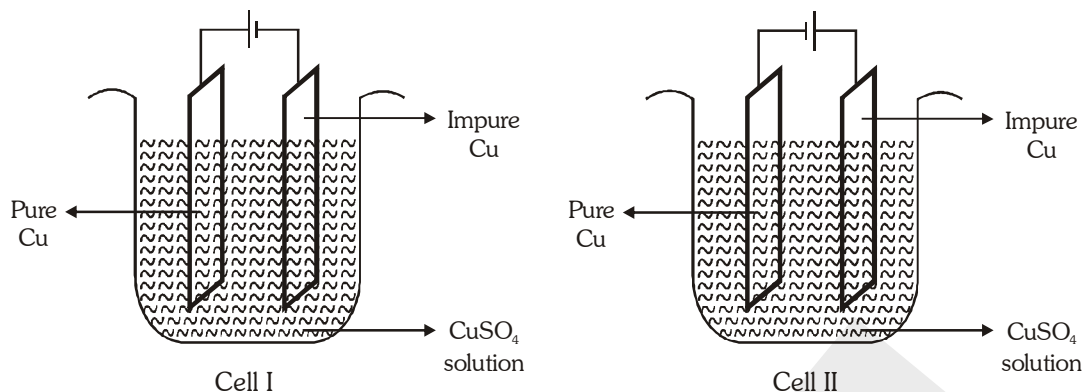
(3) H will form a covalent compound with A

(4) B is small in size as compared to D and K

Ans. (4)

Sol. B is small in size as compared to D, but B is bigger in size as compared to K.

24. Consider the electrochemical cells (I and II) shown in the following figures and select the correct statement about these cells.



- (1) Cell I produces purer copper than Cell II
- (2) In both cells, insoluble impurities settle down
- (3) Copper from cathode will deposit on anode in cell I
- (4) Copper from anode will deposit on cathode in cell II.

Ans. (4)

Sol. In electrolytic cell, the impure metal is made the anode and pure metal is made the cathode. So, in this process copper from anode will deposit on cathode in cell II.

25. Read the following table:

Metal	Reaction with		
	ZnSO_4 Solution	FeSO_4 Solution	CuSO_4 Solution
X	No reaction	No reaction	No reaction
Y	No reaction	No reaction	Displacement reaction
Z	Displacement reaction	Displacement reaction	Displacement reaction

Based on the above table consider the following statements.

- (I) Reaction of Y with CuSO_4 solution produces Cu metal.
- (II) Z is the most reactive element and X is the least reactive.
- (III) Y is more reactive than X and less reactive than Z.
- (IV) Metal Y produces Zn on reaction with ZnSO_4 solution.

Which of the following options gives the correct statement ?

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

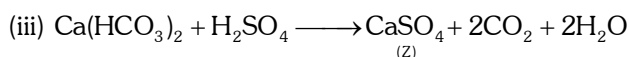
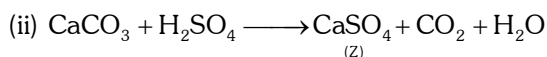
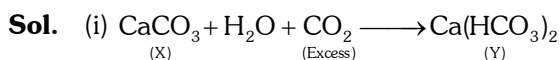
Ans. (1)

- Sol.** (I) Reaction of Y with CuSO_4 solution produce Cu metal as 'Y' comes above Cu in electrochemical series.
 (II) 'Z' is most reactive element because it is giving displacement reaction with all solutions and 'X' is least reactive element because it is not giving displacement reaction with any solutions.
 (III) 'Y' is more reactive than 'X' and less reactive than 'Z' according to displacement reaction.

26. If excess of CO_2 is passed through the suspension of a compound 'X' in water, a compound 'Y' is formed. Substances 'X' and 'Y' dissolve in H_2SO_4 giving white compound 'Z' which is insoluble in water. Identify the compounds 'X', 'Y' and 'Z'.

- (1) CaSO_4 , CaCO_3 , gypsum (2) CaSO_4 , CaHCO_3 , lime
 (3) CaCO_3 , CaHCO_3 , CaSO_4 (4) CaHCO_3 , CaCO_3 , CaSO_4

Ans. (NA)



'X' \rightarrow CaCO_3

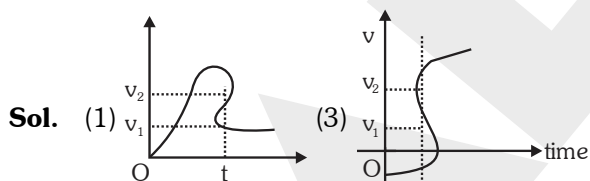
'Y' \rightarrow $\text{Ca(HCO}_3)_2$

'Z' \rightarrow CaSO_4

27. Figures given below show velocity-time curves for a moving object. Identify the one which may be realised in practice.

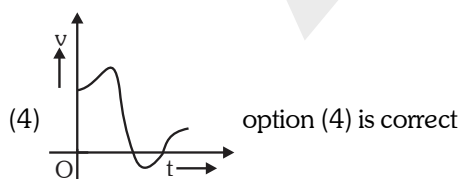


Ans. (4)

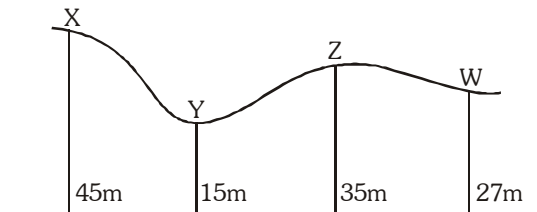


Option (1) and (3) are not possible as at an instant there will be two velocities.

and in option (2) the slope is infinite at a particular time instant t (means acceleration will be infinite). It is also not possible



28. Two balls A and B are released towards point W from point X and point Z respectively, on a perfectly smooth track as shown in the figure. The balls move along the track without losing contact. What will be the ratio of their speeds (v_A/v_B) at point W?



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

Ans. (4)

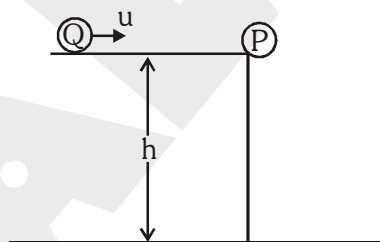
Sol. Let velocities of A and B at point W is V_A and V_B .

KE of ball A at point W is equal to loss of PE and for ball B also similar applied.

$$\therefore \frac{\frac{1}{2}mV_A^2}{\frac{1}{2}mV_B^2} = \frac{mg(45 - 27)}{mg(35 - 27)}$$

$$\frac{V_A^2}{V_B^2} = \frac{18}{8} \Rightarrow \frac{V_A}{V_B} = \frac{3}{2}$$

29. A marble P of mass 'm' lies at rest on the edge of a perfectly horizontal surface of a table of height 'h', as shown in the figure. A second identical marble Q having same mass moving at a speed 'u' strikes it perfectly elastically. The speed acquired by marble P after the collision :



[In an elastic collision, momentum as well as kinetic energy are conserved]

- (1) 0 (2) $\frac{1}{2}u$ (3) U (4) 2u

Ans. (3)

Sol. In elastic collision if masses are identical the velocity will interchange.
 Therefore after collision velocity of Q will become 0 and of P becomes U.
 Also for elastic collision $e = 1$

$$e = \frac{v_2 - v_1}{u_1 - u_2} \left(\frac{\text{velocity of separation}}{\text{velocity of approach}} \right)$$

$$1 = \frac{v_2 - v_1}{u = 0}$$

$$u = v_2 - v_1 \quad \dots(1)$$

Also momentum is conserved

$$mu_1 + mu_2 = mv_1 + mv_2$$

$$mu = m(v_1 + v_2)$$

$$u = v_1 + v_2 \quad \dots(2)$$

Solving (1) and (2)

$$v_2 - v_1 = v_1 + v_2$$

$$2v_1 = 0$$

$$v_1 = 0$$

$$v_2 = u$$

30. A block floats with its fraction η_E inside water when immersed in a beaker containing water and kept on the earth.
 The beaker along with the block is shifted to the surface of the moon. If η_M is the fraction of the block now immersed in water, which of the following relations is correct?

- (1) $\eta_M = \frac{1}{6} \eta_E$ (2) $\eta_M = 6\eta_E$ (3) $\eta_M = \eta_E$ (4) $\eta_M = \frac{1}{\sqrt{6}} \eta_E$

Ans. (3)

Sol. When objects floats Buoyance force on it = weight of object

$$\text{On earth} \rightarrow \rho \times v' \times g = mg \text{ (where } v' = \text{volume immersed)} \quad \dots(1)$$

$$\text{On moon} \rightarrow \rho \times v'' \times \frac{g}{4} = m \times \frac{g}{4} \quad \dots(2)$$

Solving (1) and (2)

$$\frac{v'}{v''} = 1$$

$$v' = v''$$

31. The weight of an object on a planet is 0.25 times of its weight on earth. A pendulum clock that ticks once every second on earth is taken to the planet. On that planet the clock would tick once in every :

- (1) 1.0 s (2) 2.0 s (3) 3.0 s (4) 4.0 s

Ans. (2)

Sol. Let acceleration due to gravity on planet $\rightarrow g'$

$$\therefore mg' = 0.25 (mg)$$

$$g' = \frac{g}{4}$$

On earth

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$1 = 2\pi\sqrt{\frac{\ell}{g}}$$

\therefore On planet (time period of pendulum will be)

$$T' = 2\pi\sqrt{\frac{\ell}{\frac{g}{4}}}$$

$$\Rightarrow T' = 2 \times 2\pi\sqrt{\frac{\ell}{g}}$$

$$T' = 2 \text{ sec}$$

32. A ball is thrown vertically upwards at a speed u and returns back to the thrower. There are two instants at which the ball has equal kinetic and potential energies. The difference between these two instants is :

(1) $\frac{1}{\sqrt{2}}\left(\frac{u}{g}\right)$

(2) $\frac{u}{g}$

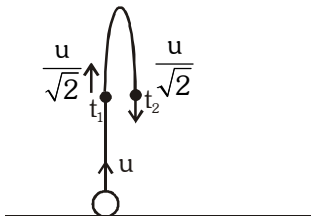
(3) $\sqrt{2}\left(\frac{u}{g}\right)$

(4) $2\left(\frac{u}{g}\right)$

Ans. (3)

Sol. Initial velocity with which the ball is thrown = u

When velocity will be $\frac{u}{\sqrt{2}}$ the ball will have equal kinetic and potential energies.



Using $v = u + gt$

t_1 (the instant at which velocity is $\frac{u}{\sqrt{2}}$ upwards)

$$t_1 = \frac{u - \frac{u}{\sqrt{2}}}{g}$$

Similarly $t_2 = \frac{u + \frac{u}{\sqrt{2}}}{g}$

Therefore

$$\begin{aligned} &= t_2 - t_1 = \frac{u + \frac{u}{\sqrt{2}}}{g} - \frac{\sqrt{2}u + u}{\sqrt{2}g} \\ &= \frac{2u}{\sqrt{2}g} \Rightarrow \sqrt{2} \frac{u}{g} \end{aligned}$$

- 33.** The potential energy stored in a spring when compressed by a length 'x' is $\frac{1}{2}kx^2$ and the force required to compress it is 'kx'; 'k' is a constant of the spring known as spring constant. The spring is placed on a floor upright and a stone of mass 10 kg falls and hits the spring with a speed 10 m/s. The spring is compressed by 5 cm. Assuming that there is no loss of energy, what is the value of 'k'?

[Given : acceleration due to gravity is 10 m/s^2]

- (1) $2.0 \times 10^{-2} \text{ N/m}$ (2) $8.0 \times 10^4 \text{ N/m}$ (3) $4.0 \times 10^5 \text{ N/m}$ (4) $2.0 \times 10^6 \text{ N/m}$

Ans. (3)

Sol. $W_{\text{all force}} = \Delta \text{KE}$ [During the compression]

$$\text{Work done by gravity} + \text{Work done by spring force} = 0 - \frac{1}{2}mv^2$$

$$mgx = \left(0 - \frac{1}{2}kx^2\right) = -\frac{1}{2}mv^2$$

$$mgx + \frac{1}{2}mv^2 = \frac{1}{2}kx^2$$

$$10 \times 10 \times 5 \times 10^{-2} + \frac{1}{2} \times 10 \times (10)^2 = \frac{1}{2}k(5 \times 10^{-2})^2$$

$$505 = \frac{1}{2} \times k \times 25 \times 10^{-4}$$

$$k = 40.4 \times 10^4$$

$$k = 4.04 \times 10^5 = 4.0 \times 10^5 \text{ N/m}$$

- 34.** A girl drops a ball from a height $h = 20$ m. It strikes the ground elastically and returns to her hand. An echo of the thud of the ball striking the ground is produced from nearby cliff.

The echo is heard at exactly the same moment when the ball returns to the girl's hand. (Take $g = 10 \text{ m/s}^2$ and $v_{\text{sound}} = 350 \text{ m/s}$.) The distance of the cliff from the girl is close to :

- (1) 350 m (2) $350\sqrt{2}$ m (3) 700 m (4) 3500 m

Ans. (1)

Sol. Time taken by ball to reach the ground $\rightarrow t$

The ball is dropped at $t = 0$

$$h = ut + \frac{1}{2}gt^2$$

$$-20 = \frac{1}{2}(-g)t^2$$

$$4 = t^2$$

$$t = 2 \text{ sec}$$

\therefore Sound is generated at instant $t = 2$ sec.

In next 2 sec ball reaches in hand of girl

\therefore Echo is heard after interval of 2 sec.

Distance between cliff and girl is x .

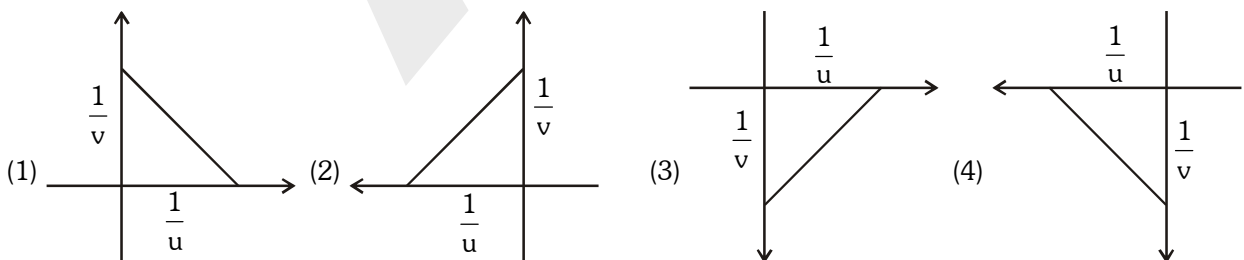
For sound

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$350 = \frac{2x}{2}$$

$$x = 350 \text{ m}$$

- 35.** Four graphs between $\frac{1}{u}$ and $\frac{1}{v}$ are given for spherical mirrors. Which one of them suitably represents a convex mirror, as per the new Cartesian sign convention ?



Ans. (2)

Sol. For convex mirror

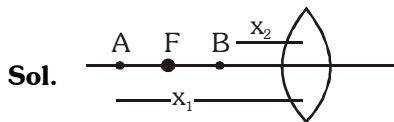
$$\frac{1}{u} \rightarrow -ve \qquad \frac{1}{v} \rightarrow +ve$$

As the object approaches focus $\frac{1}{u}$ increases numerically and $\frac{1}{v}$ decreases.

36. An object is placed at point A in front of a convex lens of focal length f . Its real, inverted and magnified image is formed behind the lens. When the object is brought closer to the lens and placed at a point B, a virtual and erect image, but with exactly the same magnification (in magnitude) as before is formed in front of the convex lens. Let F be the focus of the lens in front of it. Which of the following relations is correct ?

- (1) $AF = FB$ (2) $AB = f$ (3) $AF - BF = f$ (4) $AB = 2F$

Ans. (1)



In first case image is real and inverted

$$m_1 = \frac{f}{-x_1 + f}$$

In second case image is virtual and erect.

$$m_2 = \frac{f}{-x_2 + f}$$

$$m_1 = -m_2$$

$$\frac{f}{-x_1 + f} = \frac{-f}{-x_2 + f}$$

$$\Rightarrow x_1 + x_2 = 2f \qquad \dots(1)$$

$$AF = x_1 - f$$

$$BF = f - x_2$$

$$AF - BF = x_1 + x_2 - 2f \qquad \dots(2)$$

$$AF - BF = 0$$

$$AF = BF$$

37. Nethra, who is a back-bencher, discovers one day in the class that she is unable to discern the details on the blackboard very well. When she visits an optician, he prescribes glasses for her.

Which of the following statement(s) is/are false ?

- I. She suffers from myopia where the far point is nearer than the blackboard.
- II. A concave lens with a suitable power can help correct her vision.
- III. Her eye is defective and is forming images in front of the retina.
- IV. A concave lens or a convex lens may be used to correct her vision.

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

Ans. (4)

Sol. As the board is far away

∴ Nethra is suffering from near sightedness (myopia)

Myopia is corrected using concave lens and in myopic eye the image forms in front of retina.

∴ Statement I, II and III are correct

38. Consider three resistors of resistances R_1 , R_2 and R_3 such that $R_1 < R_2 < R_3$. Two of them are connected in parallel, and then connected in series with the third. Which one of the following configurations yields the highest current when connected to the same battery ?

(1) R_1 and R_2 in parallel, with R_3 in series

(2) R_1 and R_3 in parallel, with R_2 in series

(3) R_2 and R_3 in parallel, with R_1 in series

(4) It will depend on the precise values of R_1 , R_2 and R_3

Ans. (3)

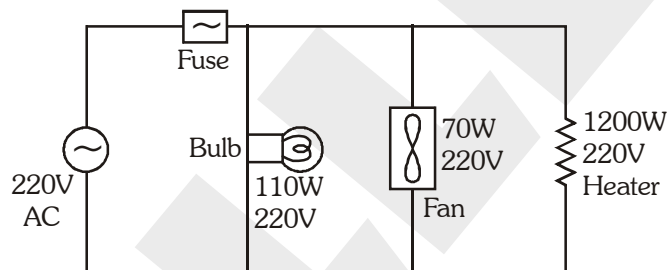
Sol. $\frac{V}{R_{eq}} = I$

∴ For I to be maximum in circuit the equivalent resistance of circuit (R_{eq}) should be minimum.

When two resistors are connected in parallel combination R_{eq} is less than least individual resistance.

∴ Connecting R_2 and R_3 in parallel will decrease the value.

39. Figure shows three electrical appliances connected to a 220 V ac mains. What is the amperage (current rating) of the fuse that should be used in the circuit ?



(1) 1.0 A

(2) 2.0 A

(3) 5.0 A

(4) 10.0 A

Ans. (4)

Sol. $P_{eq} = 110 + 70 + 1200$ (In parallel)

$P_{eq} = 1380$ W

∴ $I = \frac{P_{eq}}{V} = \frac{1380}{220} = 6.27$ A

40. A positively charged plate and a negatively charged plate are kept parallel to each other at a distance of 10 cm. An electron is released near the negative plate. Looking from the negative plate towards the positive plate, the magnetic field produced by the moving electron will be :

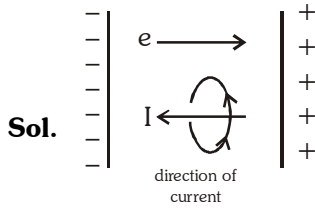
(1) clockwise

(2) anti-clockwise

(3) positive to negative plate

(4) negative to positive plate

Ans. (2)



∴ Looking from -ve plate toward positive plate.

The field will be anti-clockwise.

41. If $x = \frac{\sqrt{5} - \sqrt{2}}{2\sqrt{3} + \sqrt{5} - \sqrt{2}}$, then the value of $\frac{x\sqrt{10} + \sqrt{2}}{x\sqrt{10} + 2\sqrt{5}}$ is

(1) $\frac{15 + \sqrt{10}}{41}$

(2) $\frac{15 - \sqrt{10}}{41}$

(3) $\frac{15 + \sqrt{10}}{43}$

(4) $\frac{15 - \sqrt{10}}{47}$

Ans. (3)

Sol. $\frac{x\sqrt{10} + \sqrt{2}}{x\sqrt{10} + 2\sqrt{5}} = \frac{(x\sqrt{5} + 1)\sqrt{2}}{\sqrt{5}(x\sqrt{2} + 2)}$

$$= \frac{(x\sqrt{5} + 1)}{\sqrt{5}(x + \sqrt{2})} = \frac{x\sqrt{5} + 1}{\sqrt{5}x + \sqrt{10}}$$

$$x = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{2}[\sqrt{6} + 2\sqrt{5}] - \sqrt{2}} = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{2}(\sqrt{5} + 1) - \sqrt{2}}$$

$$x = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{2}\sqrt{5}}$$

$$x\sqrt{5} = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{2}} \Rightarrow x\sqrt{5} + 1 = \frac{\sqrt{5} - \sqrt{2} + \sqrt{2}}{\sqrt{2}} = \frac{\sqrt{5}}{\sqrt{2}}$$

$$\sqrt{5}x = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{2}} \Rightarrow \sqrt{5}x + \sqrt{10} = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{2}} + \sqrt{10}$$

$$\sqrt{5}x + \sqrt{10} = \frac{\sqrt{5} - \sqrt{2} + 2\sqrt{5}}{\sqrt{2}}$$

$$= \frac{3\sqrt{5} - \sqrt{2}}{\sqrt{2}}$$

$$\frac{x\sqrt{5} + 1}{\sqrt{5}x + \sqrt{10}} = \frac{\sqrt{5}}{\sqrt{2}} \times \frac{\sqrt{2}}{3\sqrt{5} - \sqrt{2}}$$

$$= \frac{\sqrt{5}}{3\sqrt{5} - \sqrt{2}} \times \frac{3\sqrt{5} + \sqrt{2}}{3\sqrt{5} + \sqrt{2}}$$

$$= \frac{15 + \sqrt{10}}{43}$$

- 42.** On dividing a natural number x by 11, the remainder is 3, and on dividing x by 17, the remainder is 9. If the number x lies between 300 and 400, then the remainder on dividing x by 21 is
 (1) 9 but not 11 (2) 11 but not 9 (3) But 9 and 11 (4) Neither 9 nor 1

Ans. (1)

Sol. $x = 11q_1 + 3$

$x = 11q_2 + 9$

LCM (11, 17) = 187

Required number = $187 \times 2 + (-8)$

= $374 - 8$

= 366

$\Rightarrow x = 366$

Now remainder = 9

- 43.** If $(ax + b)(x^5 + 1) - (5x + 1)$ is divisible by $x^2 + 1$, then the value of $2a + 3b$ is
 (1) 5 (2) 10 (3) 12 (4) 13

Ans. (4)

Sol.

$$\begin{array}{r}
 \overline{ax^4 + bx^3 - ax^2 - bx + a} \\
 x^2 + 1 \overline{)ax^6 + bx^5 + (a - 5)x + (b - 1)} \\
 \underline{-ax^6 - ax^4} \\
 bx^5 - ax^4 + (a - 5)x + (b - 1) \\
 \underline{-bx^5 - bx^3} \\
 -ax^4 - bx^3 + (a - 5)x + (b - 1) \\
 \underline{+ax^4 + ax^2} \\
 -bx^3 + ax^2 + (a - 5)x + (b - 1) \\
 \underline{+bx^3 + bx} \\
 ax^2 + (a + b - 5)x + (b - 1) \\
 \underline{-ax^2 - a} \\
 (a + b - 5)x + (b - a - 1)
 \end{array}$$

As remainder = 0

$\therefore a + b - 5 = 0$ and $b - a - 1 = 0$

$\Rightarrow a = 2, b = 3$

$\Rightarrow 2a + 3b = 4 + 9 = 13$

- 44.** Suppose the graphs of $15x + 20y = -2$ and $x - y = -2$ intersect at a point P. If the graph of $2x + 3y = k^2$ passes through P, then k is
 (1) An integer (2) A positive integer (3) A negative integer (4) Not an integer but rational

Ans. (1)

Sol. $15x + 20y = -2$ (1)

$x - y = -2$ (2)

(1) - (2) $\Rightarrow 14x + 21y = 0$

$\Rightarrow 2x + 3y = 0$

$\Rightarrow k^2 = 0$

45. The sum of the squares of the third and the thirteenth terms of an A.P. is 5, and the product of the fourth and twelfth terms is R. Then, the product of the third and thirteenth terms of the AP is

(1) $\frac{80 + 50R}{41}$

(2) $\frac{80 + 50R}{82}$

(3) $\frac{100R - 45}{82}$

(4) $\frac{100R - 45}{41}$

Ans. (3)

Sol. $(a + 2d)^2 + (a + 12d)^2 = 5$... (1)

$(a + 3d) \cdot (a + 11d) = R$... (2)

$(a + 2d)(a + 12d) = ?$

$\Rightarrow (a + 2d + d)(a + 12d - d) = R$

$(a + 2d)(a + 12d) - d(a + 2d) + d(a + 12d) - d^2 = R$

$(a + 2d)(a + 12d) - d(-10d) - d^2 = R$

$(a + 2d)(a + 12d) + 9d^2 = R$

$K = R - 9d^2$... (3)

From (1) $[(a + 12d) - (a + 2d)]^2 + 2(a + 12d)(a + 2d) = 5$

$\Rightarrow 100d^2 + 2K = 5$

$2K = 5 - 100d^2$... (4)

(3) $\times 100 -$ (4) $\times 9$

$100K = 100R - 900d^2$

$-18K = -45 + 900d^2$

$K = \frac{100R - 45}{82}$

46. If α and β are the roots of the quadratic equation $2x^2 - 5x - 6 = 0$ and $P_{n+1} = \alpha^n - \beta^n$, then the value of $\frac{P_9 - 3P_7}{4P_8}$ is

(1) $\frac{3}{8}$

(2) $\frac{5}{8}$

(3) $\frac{7}{8}$

(4) $\frac{9}{8}$

Ans. (2)

Sol. $2 \cdot \alpha^2 - 5\alpha - 6 = 0$

Multiplying by α^6

$2\alpha^8 - 5\alpha^7 - 6\alpha^6 = 0$

$2\beta^8 - 5\beta^7 - 6\beta^6 = 0$

$2(\alpha^8 - \beta^8) - 5(\alpha^7 - \beta^7) - 6(\alpha^6 - \beta^6) = 0$

$2P_9 - 5P_8 - 6P_7 = 0$

$2P_9 - 6P_7 = 5P_8$

$\frac{2(P_9 - 3P_7)}{P_8} = 5$

$\frac{P_9 - 3P_7}{4P_8} = \frac{5}{2 \times 4} = \frac{5}{8}$

47. A number is picked up at random from the numbers from 1 to 1000. The probability that it is of the form m^n (where $m > 1, n > 1$) is

(1) $\frac{1}{20}$

(2) $\frac{1}{25}$

(3) $\frac{1}{30}$

(4) $\frac{1}{39}$

Ans. (2)

Sol. $2^2, \dots, 2^9 \longrightarrow 8$

$3^2, \dots, 3^6 \longrightarrow 5$

$5^2, 5^3, 5^4 \longrightarrow 3$

$6^2, 6^3 \dots \longrightarrow 2$

$7^2, 7^3 \longrightarrow 2$

$10^2, 10^3 \longrightarrow 2$

$\{11^2, \dots, 31^2\} - \{16^2, 27^2, 25^2\} \longrightarrow 21 - 3 = 18$

Total numbers are = 40

$$P = \frac{40}{1000} = \frac{1}{25}$$

48. Let $A(-5, 5)$, $B(4, -5)$ and $C(4, 5)$ be the vertices of the triangle ABC . If a circle passes through the vertices of ΔABC then the area (in sq. units) lying inside the circle but outside the ΔABC is

(1) $\frac{181}{2}\pi - 45$

(2) $\frac{181}{2}\pi - 40$

(3) $\frac{181}{4}\pi - 45$

(4) $\frac{181}{4}\pi - 40$

Ans. (3)

Sol. $AC = 9$

$BC = 10$

ABC is a right angled Δ .

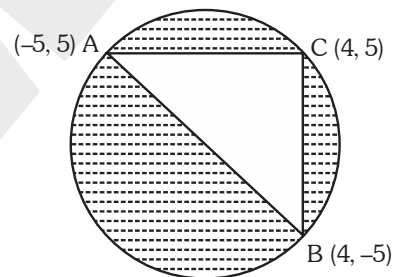
$$\text{Circumradius } r = \frac{AB}{2} = \frac{\sqrt{181}}{2}$$

Area of shaded region

$$= \pi r^2 - \text{Ar}(\Delta ABC)$$

$$= \frac{\pi(181)}{4} - \frac{1}{2} \times 9 \times 10$$

$$= \frac{(181)\pi}{4} - 45$$



49. The coordinates of points A, B and C are (7, 4), (3, 1) and (0, k), respectively. Then, the value of k, such that AC + BC is minimum, is

- (1) $\frac{-5}{4}$ (2) $\frac{19}{10}$ (3) $\frac{5}{4}$ (4) $\frac{9}{10}$

Ans. (2)

Sol. B' is reflection of B in y-axis

$$\Rightarrow B'C = BC$$

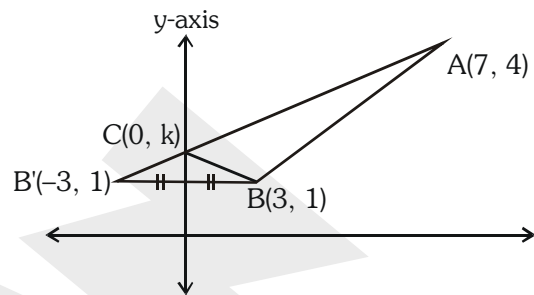
For AC + BC to be minimum A, C and B' should be collinear

$$\Rightarrow \frac{k-4}{0-7} = \frac{1-4}{-3-7}$$

$$\Rightarrow \frac{k-4}{-7} = \frac{-3}{-10}$$

$$\Rightarrow k-4 = \frac{-21}{10}$$

$$\Rightarrow k = 4 - \frac{21}{10} = \frac{40-21}{10} = \frac{19}{10}$$



50. Two tangents PA and PB are drawn to a circle with centre O from an external point P. The chord AB intersects the line segment PO at Q. Then, the square of the radius of the circle is

- (1) $OQ \times QP$ (2) $OQ \times OP$ (3) $PQ \times AB$ (4) $PA \times PB$

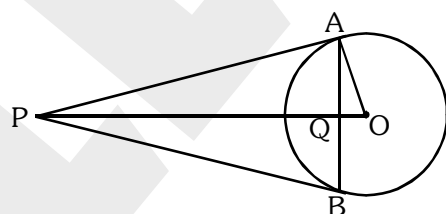
Ans. (2)

Sol. $\triangle PAO \sim \triangle AQO$ (AAA)

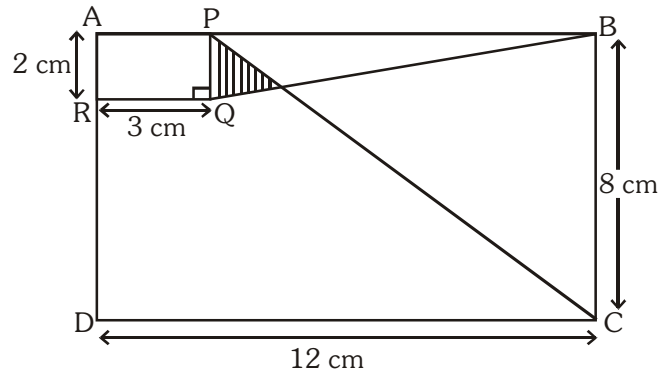
$$\frac{PA}{AQ} = \frac{AO}{QO} = \frac{PO}{AO}$$

$$\Rightarrow AO \times AO = PO \times QO$$

$$\Rightarrow AO^2 = OQ \times OP$$

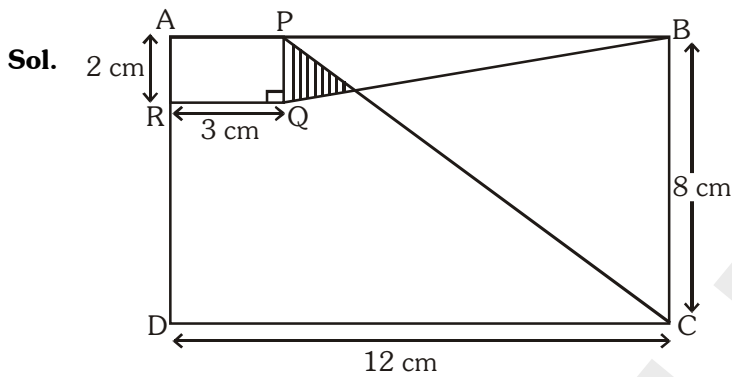


51. In the given figure, ABCD is a rectangle. Then, the area of the shaded region is



- (1) 1.2 sq. units (2) 1.4 sq. units (3) 1.6 sq. units (4) 1.8 sq. units

Ans. (4)



$\triangle PLQ \sim \triangle CLB$ (AAA)

$$\frac{\text{Ar.}(\triangle PLQ)}{\text{Ar.}(\triangle CLB)} = \left(\frac{PQ}{CB}\right)^2 = \left(\frac{2}{8}\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$$

$$\Rightarrow \text{Ar}(\triangle PLQ) = \frac{1}{16} \times \text{Ar}(\triangle CLB)$$

Now, $QS = 12 - 3 = 9$ cm

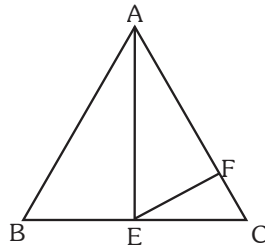
$$\Rightarrow \frac{\text{height}(\triangle PLQ)}{\text{height}(\triangle BLC)} = \frac{1}{4}$$

and sum of height of both triangle = 9

$$\Rightarrow \text{height}(\triangle PLQ) = \frac{1}{5} \times 9 = \frac{9}{5} \text{ cm}$$

$$\Rightarrow \text{Area}(\triangle PLQ) = \frac{1}{2} \times 2 \times \frac{9}{5} = \frac{9}{5} = 1.8 \text{ sq. units}$$

52. In the given figure, ABC is an isosceles triangle with AB = AC. If AE = AF and $\angle BAE = 40^\circ$, then the measure of the angle FEC is



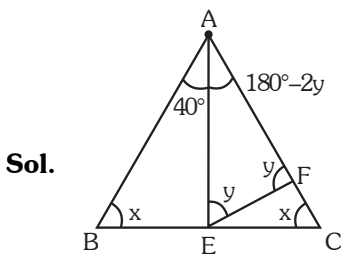
(1) 15°

(2) 20°

(3) 40°

(4) 60°

Ans. (2)



$$\Rightarrow 40^\circ + 180^\circ - 2y + x + x = 180^\circ$$

$$40^\circ - 2y + 2x = 0$$

$$\Rightarrow 2y - 2x = 40^\circ$$

$$y - x = 20^\circ$$

$$\Rightarrow \angle FEC = y - x = 20^\circ$$

53. In an equilateral $\triangle ABC$, side BC is produced to D and $DF \perp AB$ such that DF is intersecting AC at E. If $BC = 2 CD$ and $AF = 6$ cm, then the length (in cm) of BF is

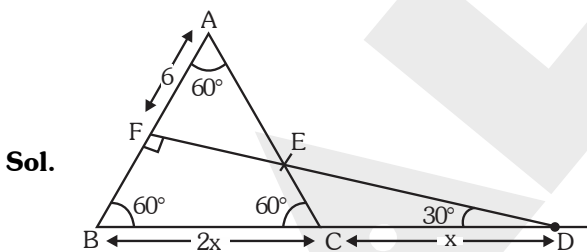
(1) 9

(2) 12

(3) 15

(4) 18

Ans. (4)



$$BF = 2x - 6$$

$$\cos 60^\circ = \frac{BF}{BD} = \frac{1}{2} \Rightarrow \frac{1}{2} = \frac{2x - 6}{3x}$$

$$\Rightarrow 3x = 4x - 12$$

$$\Rightarrow x = 12$$

$$\text{Now } BF = 2(12) - 6 = 24 - 6 = 18 \text{ cm}$$

54. Water is flowing at the rate of 10 cm/minute through a pipe of diameter 10 cm into an empty bucket, which is in the form of frustum of a cone of height 30 cm with radii of its lower and upper ends as 10 cm and 20 cm respectively. Then, the time in which the level of water in the bucket will rise 15 cm, is

- (1) $\frac{\sqrt{17}}{10}$ minutes (2) $\frac{\sqrt{19}}{5}$ minutes (3) $\frac{\sqrt{17}}{5}$ minutes (4) $\frac{\sqrt{19}}{10}$ minutes

Ans. (Bonus)

Sol. $r = 5$ cm

$$\frac{h}{h+15} = \frac{10}{r} \quad \dots (1)$$

$$\frac{h}{h+30} = \frac{10}{20} \quad \dots (2)$$

$$\Rightarrow 20h = 10h + 300$$

$$\Rightarrow 10h = 300$$

$$h = 30$$

Now in eq. (1)

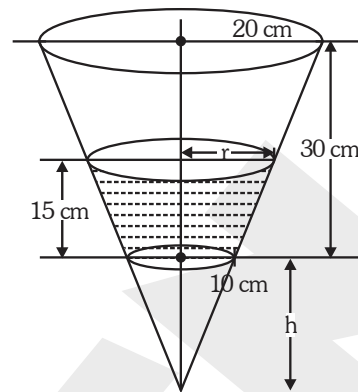
$$\frac{30}{45} = \frac{10}{r}$$

$$\boxed{r = 15 \text{ cm}}$$

$$\text{Now, } \pi(5)^2 \times 10 \times t = \frac{1}{3} \pi \times 15(100 + 225 + 150)$$

$$\Rightarrow 250t = 5 \times (475)$$

$$t = \frac{5 \times 475}{250} = \frac{475}{50} = \frac{19}{2} \text{ minutes}$$



55. The largest possible area of ΔABC with $AB = 5$ cm and the sum of other two sides as 7 cm is

- (1) $5\sqrt{6}$ cm² (2) $\frac{5}{2}\sqrt{6}$ cm² (3) $\frac{5}{2}\sqrt{3}$ cm² (4) $5\sqrt{3}$ cm²

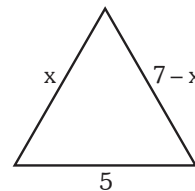
Ans. (2)

Sol. $AB = 5$ cm, $BC + CA = 7$ cm

$$s = \frac{5+7}{2} = 6$$

$$\Delta = \sqrt{6(6-5)(6-x)(6-7+x)}$$

$$\Delta = \sqrt{6 \times 1 \times (6-x)(x-1)}$$



$$\Delta = \sqrt{6(6-x)(x-1)}$$

$$\Delta = \sqrt{6(6x-6-x^2+x)}$$

$$\Delta = \sqrt{6(-x^2+7x-6)}$$

$$\text{As, } (-x^2+7x-6)_{\max} = \frac{-(49-4x(-1) \times (-6))}{4 \times (-1)} = \frac{-(49-24)}{-4}$$

$$= \frac{25}{4}$$

$$\Rightarrow \Delta_{\max} = \sqrt{6 \times \frac{25}{4}} = \frac{5}{2} \sqrt{6} \text{ cm}^2$$

56. If $u = \cos \theta \left(\sin \theta + \sqrt{\sin^2 \theta + \sin^2 \alpha} \right)$ then $|u|$ is less than or equal to

(1) $\sqrt{1 + \sin^2 \alpha}$

(2) $\sqrt{1 + \cos^2 \alpha}$

(3) $\sqrt{2 + \sin^2 \alpha}$

(4) $\sqrt{2 + \cos^2 \alpha}$

Ans. (1)

Sol. $u = \cos \theta \left(\sin \theta + \sqrt{\sin^2 \theta + \sin^2 \alpha} \right)$

$$u \sec \theta = \sin \theta + \sqrt{\sin^2 \theta + \sin^2 \alpha}$$

$$(u \sec \theta - \sin \theta)^2 = \sin^2 \theta + \sin^2 \alpha$$

$$u^2 \sec^2 \theta + \sin^2 \theta - 2u \tan \theta = \sin^2 \theta + \sin^2 \alpha$$

$$u^2 (1 + \tan^2 \theta) - 2u \tan \theta - \sin^2 \alpha = 0$$

$$u^2 \tan^2 \theta - 2u \tan \theta + u^2 - \sin^2 \alpha = 0$$

$$\tan \in \mathbb{R}$$

$$D \geq 0$$

$$(-2u)^2 - 4u^2 (u^2 - \sin^2 \alpha) \geq 0$$

$$4u^2 - 4u^4 + 4u^2 \sin^2 \alpha \geq 0$$

$$u^2 [u^2 - (1 + \sin^2 \alpha)] \leq 0$$

$$\begin{array}{c} + \quad \text{---} \quad + \\ | \quad \quad | \\ 0 \quad \quad 1 + \sin^2 \alpha \end{array}$$

$$\text{As, } 0 \leq u^2 \leq 1 + \sin^2 \alpha$$

$$\Rightarrow -\sqrt{1 + \sin^2 \alpha} \leq u \leq \sqrt{1 + \sin^2 \alpha}$$

$$\Rightarrow |u| \leq \sqrt{1 + \sin^2 \alpha}$$

57. Two straight roads OA and OB intersect at O. A tower is situated in the interior of the angle formed by them and subtends an angle of 45° and 30° at the points A and B respectively, where the roads are nearest to it. If $OA = a$ and $OB = b$, then the height of the tower is

- (1) $\sqrt{\frac{a^2 - b^2}{2}}$ (2) $\sqrt{\frac{b^2 - a^2}{2}}$ (3) $\sqrt{\frac{3(b^2 - a^2)^2}{2}}$ (4) $\sqrt{\frac{3(a^2 - b^2)^2}{2}}$

Ans. (Bonus)

58. ABCD is a square of side 8 cm, P is the mid-point of AD and is joined with vertex B. A perpendicular is drawn from the vertex C on BP, which intersects BP at point E. The area of the triangle BEC is

- (1) $\frac{64}{5} \text{ cm}^2$ (2) $\frac{64}{\sqrt{5}} \text{ cm}^2$ (3) $\frac{32}{5} \text{ cm}^2$ (4) $\frac{32}{\sqrt{5}} \text{ cm}^2$

Ans. (1)

Sol. $\triangle ABP \sim \triangle ECB$ (AAA)

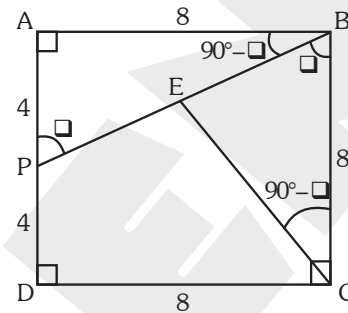
$$\Rightarrow \frac{AB}{EC} = \frac{BP}{CB} = \frac{AP}{EB}$$

$$\Rightarrow \frac{8}{EC} = \frac{4\sqrt{5}}{8} = \frac{4}{EB}$$

$$\Rightarrow EB = \frac{8}{\sqrt{5}} \text{ and } EC = \frac{16}{\sqrt{5}}$$

$$\text{Now Area}(\triangle BEC) = \frac{1}{2} \times BE \times EC = \frac{1}{2} \times \frac{8}{\sqrt{5}} \times \frac{16}{\sqrt{5}}$$

$$\Rightarrow \frac{64}{5} \text{ cm}^2$$



59. The mean of three numbers is 10 more than the least number and 15 less than the greatest number. If the median of three numbers is 5, then the sum of squares of these numbers is :

- (1) 625 (2) 650 (3) 675 (4) 725

Ans. (2)

Sol. $a < b < c$

$$\frac{a + b + c}{3} = 10 + a \quad \dots(1)$$

$$\frac{a + b + c}{3} = c - 15 \quad \dots(2) \text{ (Given)}$$

$$b = 5 \quad \dots(3)$$

Now $a+c+5 = 30 + 3a$

$$c = 25 + 2a$$

and $a+c+5 = 3c - 45$

$$50 + a = 2c$$

$$\Rightarrow 50 + a = 2(25 + 2a)$$

$$50 + a = 50 + 4a$$

$$a = 0$$

$$c = 25$$

$$\Rightarrow a = 0, b = 5, c = 25$$

Now $a^2 + b^2 + c^2 = 0^2 + 5^2 + 25^2 = 25 + 625$
 $= 650$

60. A and B are two metallic solid spheres such that the surface area of B is 800% more than that of A. If the volume of A is x% less than that of B, then the value of x is closest to :

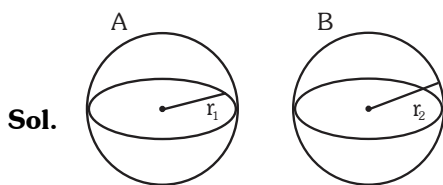
(1) 64.2

(2) 72.4

(3) 95.5

(4) 96.3

Ans. (4)



$$4\pi r_2^2 = 4\pi r_1^2 + \frac{800}{100} \times 4\pi r_1^2$$

$$4\pi r_2^2 = 9 \times 4\pi r_1^2$$

$$r_2^2 = 9 \times r_1^2$$

$$r_2 = 3r_1$$

$$\text{Vol.}_A = \frac{4}{3} \pi r_1^3$$

$$\text{Vol.}_B = \frac{4}{3} \pi \times 27r_1^3$$

$$\text{Vol.}_B = 27 \times \frac{4}{3} \pi r_1^3$$

$$\Rightarrow V_B = 27 \times V_A$$

$$\Rightarrow V_A = \frac{V_B}{27}$$

$$\% \text{ change} = \frac{V_B - \frac{V_B}{27}}{V_B} \times 100\% = 100 \times \frac{26}{27} \%$$

$$= 96.29\%$$

61. Which of the following statements regarding the position and role of women during the French Revolution are correct?

- I. Olympe de Gouges was a supporter of 'The Declaration of Rights of Man and Citizen'.
- II. Women were disappointed that the Constitution of 1791 reduced them to passive citizens.
- III. The Revolutionary Government made education compulsory for girls, marriage was made into a contract and divorce was made legal.
- IV. The Revolutionary Government finally recognized women's struggle for equal Political Rights and gave them the right to vote.

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

Ans. (3)

Sol. Olympe de Gouges was a supporter of 'The Declaration of Rights of woman and Citizen'.

The Revolutionary Government did not recognize women's struggle for equal Political Rights and did not give them the right to vote.

62. Which of the following statements about socialism are correct ?

- I. Robert Owen was the founder of New Harmony.
- II. Louis Blanc wanted Government supported co-operatives.
- III. Marx argued that all property should be socially controlled.
- IV. Robert Owen also believed that workers should constructed a radically socialist society.

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

Ans. (1)

Sol. Option (IV) is irrelevant to the question, Karl Marx and Friedrich Engel believed that workers should constructed a radically socialists society.

63. Which of the following statements about Maasais are correct ?

- I. Maasais are found in Tanzania and Kenya.
- II. Samburu National Park is situated in Tanzania.
- III. The title Maasai is derived from the word 'maa', which means 'my land'.
- IV. Maasai land was taken away by not only British Kenya, but also German Tanganyika.

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

Ans. (2)

Sol. Samburu National Park is situated in Kenya.

The title Maasai is derived from the word 'maa', Maa-sai means 'my people'.

64. With regard to Polo, identify correct statements from the following.

- I. Polo was a game of European origin.
- II. Sultan Qutubuddin Aibak died while playing Polo.
- III. Polo was suitable for military and athletic young men.

- (1) Only II is true
- (2) Both I and II are true, but III is false
- (3) Both I and III are true, but II is false
- (4) Both II and III are true, but I is false

Ans. (4)

Sol. Polo was a game of Arabic origin.

65. With regard to women clothing after World War in Europe; identify the correct statements from the ones given below.

- I. Wars eroded distinctions among women in Europe.
- II. World War I shortened women's clothes for practical necessity.
- III. New schools encouraged luxurious dressing and ornamentation.

- (1) Only I is true
- (2) I and II are true but III is false
- (3) II and III are true but I is false
- (4) I and III are true but II is false

Ans. (2)

Sol. New schools encouraged simple dressing and no ornamentation as there were number of deaths in the World War and the society did not have much resources left with it.

66. In the light of political developments that took place in the first quarter of twentieth century India, match the following:

Place	Event	Year
I. Amritsar	A. Mill workers Strike	i. 1916
II. Kheda	B. Rowlatt Act	ii. 1917
III. Ahmedabad	C. Peasant Strike	iii. 1918
IV. Champaran	D. Plantation Workers Strike	iv. 1919
	E. Khilafat movement	v. 1920

- (1) I-B-iv, II-C-ii, III-A-iii, IV-D-i
- (2) I-E-ii, II-B-iv, III-A-iii, IV-D-v
- (3) I-D-iv, II-C-ii, III-A-iii, IV-B-i
- (4) I-C-ii, II-B-iv, III-A-iii, IV-E-i

Ans. (1)

Sol. All are correctly match in option (1).

67. A history excursion of your school involved a visit to four countries. It first went to a city which had a treaty signed in early nineteenth century approving of 'new conservatism'. It then travelled to the former kingdom of Sardinia-Piedmont, followed by a visit to the country one ruled by the 'Hohenzollern dynasty' and finally reaching a city where many feel sowed the seeds of Nazism and the Second World War were sown.

The correct sequence of the countries visited would be :

- (1) Austria – Italy – Germany and France (2) Germany – Italy – Austria and France
(3) France – Germany – Italy and Austria (4) Austria – Italy – France and Germany

Ans. (1)

Sol. In the 1815, Vienna congress was held in Austria which gave rise to conservatism. Sardinia-Piedmont is a part of Italy. Hohenzollern dynasty was in Germany. Treaty of Versailles was signed in France.

68. Nationalism in India which emerged as a force in the late nineteenth century meant strong devotion for :

- (1) All countries of the world
(2) One's own country, its history and culture
(3) One's own country and hatred towards others.
(4) One's own country without appreciation of other nations

Ans. (2)

Sol. All other options are irrelevant.

69. Which of the following provides the most appropriate sequence of events in the context of the French revolution ?

- (1) Increase in population – scarcity of grains-rising food prices – inability of the poor to buy bread – food riots
(2) Scarcity of grains – increase in population – rising food prices – inability of the poor to buy bread-food riots
(3) Food riots – scarcity of grains – bad harvest – rising food prices – inability of the poor to buy bread
(4) Increases in population – rising food prices – scarcity of grains – food riots – inability of the poor to buy bread.

Ans. (1)

Sol. As there was increase in population which led to scarcity of grains and rising food prices. This led to the inability of the poor to buy bread. This instigated food riots in Paris and other places.

70. Imagine yourself as a Kulak during Stalin's Collectivisation programme. Which of the following would you have excluded from your objection(s) to Collectivisation ?

- I. Support to socialism.
II. Independent cultivation
III. Work in collective farms
IV. Transfer of land to collective farms

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

Ans. (1)

Sol. Kulaks did not have any problem with independent cultivation and socialism.

Directions : (Questions 71-75)

Read the statements and select the correct answer from the options given below.

1. Statement-I is true, Statement-II is false
2. Statement-I is False, Statement-II is true
3. Both Statement are True and Statement-II provides explanation to Statement-I
4. Both Statements are True and Statement-II does not provide explanation to Statement-I

71. Statement-I : During the Civil Disobedience Movement, 'no rent' campaign were carried out in most places.

Statement-II : The relationship between the poor peasants and the Congress remained uncertain.

Ans. (4)

Sol. Statement I does not have reference of the Congress.

72. Statement-I : Mahatma Gandhi successfully organized the Satyagraha movement of 1916 and 1917 in favour of peasant.

Statement-II : In Champaran, Gandhi Ji inspired the middle class to struggle against the oppressive plantation system and in Kheda district of Gujarat he supported their demand for relaxation in revenue collection affected by crop failure.

Ans. (1)

Sol. In statement II instead of the middle class, peasants should come.

73. Statement-I : Khadar soils are poor in organic matter yet these soils are very fertile.

Statement-II : Khadar soils are fertile because they fall in the flood plain zone of the river.

Ans. (3)

Sol. Khadar soils are poor in organic matter as there was no plant growth or animal decay earlier.

74. Statement-I : Indian citizens have the right to freedom.

Statement-II : Indian citizens have the freedom to criticize the core values of the Constitution.

Ans. (4)

Sol. Both the statements are correct but the statement II does not explain statement I.

75. Statement-I : Some form of social grouping has to be expressed in politics through gender division.

Statement-II : The Panchayati Raj Act was enacted to have a fair proportion of women in the local bodies.

Ans. (3)

Sol. As the reservation policy has been enacted in the Panchayati Raj Institutions so the social group of women are bound to be expressed in politics through gender division.

76. In India, there are landlocked states as well as states with long coastlines. Madhavan is planning to travel from Srinagar to Kanyakumari. What is the minimum number of land locked and coastal states that he would have to traverse excluding the origin and destination UTs/States ?

(1) 3, 2

(2) 3, 3

(3) 2, 2

(4) 2, 3

Ans. (1, 4)

Sol. The possible route is Punjab, Rajasthan, Gujarat, Maharashtra and Karnataka.

The another possible route is Punjab, Rajasthan, Madhya Pradesh, Maharashtra and Karnataka.

- 77.** Geological structure, physiography and precipitation regimes influence evolution of drainage patterns. India with its diversity in the above mentioned attributes show cases a variety of drainage patterns across regions. Match the following drainage patterns found in the region given below

Drainage Pattern	Region
A : Centripetal	I. Narmada Basin
B : Radial	II. Godavari Basin
C : Trellis	III. Loktak
D : Dendritic	IV. Amarkantak
	V. Aravalli

- (1) A-III, B-IV, C-V, D-II (2) A-IV, B-II, C-V, D-III (3) A-III, B-IV, C-I, D-II (4) A-V, B-III, C-I, D-IV

Ans. (3)

Sol. In option (3) all are correctly matched.

- 78.** Colonialism has been so far defined in terms of political, economic and social changes brought in the colonies. The aspect related to changes bringing in the biodiversity of the colonies has received little attention. One such practice was the introduction of new species of trees by the colonizers in the colonies.

Identify two trees that were introduced by colonizers in India.

- I. Birch
- II. Teak
- III. Chir Pine
- IV. Rhododendron

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

Ans. (2)

Sol. Teak and Chir Pine were introduced by colonizers in India.

- 79.** Indian farmers adopt diverse farming practices in different environmental conditions in order to maximize the yield. Identify the type of farming where the second crop is seeded even before the harvesting of the previous standing crop.

- (1) Inter cropping (2) Mixed cropping (3) Relay cropping (4) Multiple cropping

Ans. (3)

Sol. Relay cropping is used in order to maximize the yield. The second crop is seeded even before the harvesting of the previous standing crop.

- 80.** During the South-West monsoon season, India receives the maximum amount of rainfall. However, it varies from place to place. Choose the correct sequence of regions arranged in descending order of rainfall received from South West Monsoon.

- (1) Khasi Hills, Western Ghats, Bengal Delta (2) Western Ghats, Khasi Hills, Bengal Delta
 (3) Bengal Delta, Khasi Hills, Western Ghats (4) Bengal Delta, Western Ghats, Khasi Hills

Ans. (1)

Sol. Khasi Hills receives more rainfall than Western Ghats and the Western Ghats receives more rainfall than the Bengal Delta.

81. Different types of soils are found in India having special characteristic features. One of these extends approximately between 13 degree N to 25 degree N latitudes and 72 degree E to 82 degree E longitudes. Identify the soil type from the given options.

- (1) Red soil (2) Black soil (3) Laterite soil (4) Red and Yellow soil

Ans. (2)

Sol. The location indicates the region of Black soil.

82. Samanwita is taking her friends from Gandhinagar to her Grand Parents' home located in Kolkata. They board the flight from Gandhinagar and fly over Bhopal and Ranchi to reach Kolkata. Which of the following statements are true regarding their travel?

- I. Travelled over saline soils, badlands, calcareous soil and alluvial soils.
 II. Flew across Vindhya, Bundelkhand, Chotanagpur plateau and Rahr regions.
 III. Almost traversed along the Tropic of Cancer.
 IV. Crossed rivers Chambal, Son and Damodar on the way.

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

Ans. (4)

Sol. Only the statements III and IV are correct.

83. The Western Ghats and Eastern Ghats are marked by many differences in terms of geographical aspects. Which of the following statements are true about the Eastern and Western Ghats?

- I. Western Ghats are more continuous than Eastern Ghats.
 II. Cardamom Hills, Javadi Hills, Shevaroy Hills and Nallamalai Hills are part of Eastern Ghats.
 III. Western Ghats have higher elevation than Eastern Ghats.
 IV. Doda Betta and Mahendragiri are the highest peaks of Western and Eastern Ghats respectively.

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

Ans. (NA)

Sol. I and III are correct.

Inappropriate options are given

Statement II. Different meaning in Hindi and English.

84. Himalayas are the young mountains originated from the sedimentary deposits of the Tethys Sea due to collision of continental plates. The process has remained active over millions of years resulting into a series of almost parallel ranges of different heights. Identify the Himalayan and Trans-Himalayan ranges from their cross-section given below.



- (1) A = Karakoram; B = Zaskar; C = Ladakh; D = Himadri.
 (2) A = Zaskar; B = Karakoram; C = Himadri; D = Ladakh.
 (3) A = Karakoram; B = Ladakh; C = Zaskar; D = Himadri.
 (4) A = Zaskar; B = Himadri; C = Ladakh; D = Karakoram

Ans. (3)

Sol. A = Karakoram; B = Ladakh; C = Zaskar; D = Himadri.

85. Rivers are an important element of the physical landscape of India. Variations in the environmental factors have resulted in the evolution of diverse drainage systems. Which of the following statements is/are incorrect about the drainage system of India?

- I. The Beas flows into Pakistan and joins Sutlej.
 - II. Sutlej and Indus are examples of antecedent drainage.
 - III. River Luni drains into Sambar Lake which is an example of inland drainage.
 - IV. The rivers flowing from the western slopes of Western Ghats are swift and have a short course.
- (1) I and III (2) I, II and III (3) II and III (4) II, III and IV

Ans. (1)

Sol. The Beas flows in India only and joins Sutlej within India itself.
River Luni does not drain into Sambar Lake. It drains into Rann of Kutch.

86. Understanding the spatio-temporal aspects of population is one of the main concerns of demographers. They have tried to measure the aspects of the same by selecting certain key indicators. Match the indicators listed in column I with the explanations given in column II

	Column I		Column II
A.	Density of population	I	Increase or decrease in population.
B.	Population Growth	II	Number of people in a given area.
C.	Natural Growth	III	Man-Land ratio.
D.	Distribution of population	IV	Birth Rate minus Death Rate
		V	In migration minus Out Migration

- (1) A-II, B-V, C-I, D-III (2) A-III, B-IV, C-I, D-II (3) A-III, B-I, C-IV, D-II (4) A-II, B-IV, C-III, D-V

Ans. (3)

Sol. All are correctly matched in option (3)

87. Federalism is the most popular form of democratic governance today. With reference to a federal political system, which of the following does NOT hold true?

- (1) Spain, Pakistan and South Africa examples of a federal system.
- (2) Holding together federations always give equal power to its constituent units.
- (3) The jurisdiction and authority of each tier of government is constitutionally mandated.
- (4) For a dispute relating to division of powers it is the High Courts and Supreme Court of India which interpret the Constitution

Ans. (2)

Sol. In Holding together federations it is not necessary to give equal power to its constituent units.

88. Regular elections are the backbone of democracy. Arrange the following election related activities in a correct sequence.

- A. Announcement of election schedule.
- B. Election Campaign.
- C. Making of voter's list.
- D. Polling of votes
- E. Counting of votes.
- F. Announcement of election results and issue of press note.

Which of the following indicates the correct sequence of activities?

- (1) C, D, F, E, B, A (2) F, C, A, B, D, E (3) A, B, C, E, D, F (4) C, A, B, D, E, F

Ans. (4)

Sol. Correct sequence is given in option (4).

89. The Constitution of India was drafted by a group of elected representatives called the Constituent Assembly. With reference to the above, the members of the Constituent Assembly from the Provinces were _____.

- (1) Directly elected by the people of those Provinces.
- (2) Elected by the Provincial Legislative Assemblies.
- (3) Nominated by the India National Congress and the Muslim League.
- (4) Nominated by the Government for their expertise on constitutional matters.

Ans. (2)

Sol. The members of the Constituent Assembly from the Provinces were elected by the Provincial Legislative Assemblies.

90. Consider the following statements about the Rule of Law :

- I. Everybody shall be ruled by law as decided by the judiciary.
- II. No man shall be punished except for clear breach of law.
- III. Everybody except persons holding constitutional positions like the President and the Election Commissioner shall be subjected to law.
- IV. The term 'Rule of Law' was coined by F.A. Hayek.

Which of the above statement/s is/are correct ?

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

Ans. (4)

Sol. No man shall be punished except for clear breach of law and the term 'Rule of Law' was not coined by F.A. Hayek. Everybody shall be ruled by law as decided by the constitution.

91. Consider the following statements about the process of Amendment in the Constitution of India :

- I. An amendment to the Constitution of India can be initiated by introduction of a bill in the Lok Sabha only.
- II. If such an amendment seeks to make changes in the federal character of the Constitution, the amendment needs to be ratified by the legislature of all the States of India.

Which of the above statement/s given above is/are correct ?

- (1) I only (2) II only (3) Both I and II (4) Neither I nor II

Ans. (4)

Sol. An amendment to the Constitution of India can be initiated both in Lok Sabha and Rajya Sabha.

If such an amendment seeks to make changes in the federal character of the Constitution, the amendment needs to be ratified by at least 50% of the legislature of States of India.

92. The Constitution of India provides for division of power between the Union and the States enumerated in three lists. Based on the division of subjects in the lists, identify the ones which are correctly matched.

- I. Citizenship and extradition - Union List
- II. Public health and sanitation - State list
- III. Forest and trade - Concurrent list
- IV. Computer software and digital privacy - State list

Choose the correct option :

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

Ans. (2)

Sol. Computer software and digital privacy comes under the Union Government as a residuary subject.

93. In a social science class, the teacher asked the students to give their opinion about ensuring food security in India. Opinions given by Pahi, Saju, Zara and Veda are given below. Whose opinion is **NOT** suitable for achieving food security ?

- (1) **Saju** : Provide subsidy for export of food grains.
- (2) **Pahi** : Increase food grain production in our country.
- (3) **Veda** : Penalise the persons who waste food grains in our country.
- (4) **Zara** : Provide free food grains to all people below poverty line in our country.

Ans. (1)

Sol. Provided subsidy for export of food grains is not a correct solution as it may lead to the shortage of food grains with in the country.

94. Inexpensive Chinese locks, are flooding the Indian markets, thus destroying the traditional lock industry of India. Which of the following methods can the Government of India take up to protect the Indian lock industry?

- I. Revalue Indian Currency.
- II. Give subsidy on the import of Chinese lock.
- III. Impose import tax on the import of Chinese lock.
- IV. Place limit on the number of goods that can be imported.

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

Ans. (4)

Sol. Subsidy on the import of Chinese lock will increase the import which is detrimental for industry in India. Revaluation of Indian Currency is not a relevant method in this case.

95. Of the 200 households in the village of Chandanwadi, 100 households are debtors. They have borrowed money from the following sources.

Sources of Credit	No. of Households
Landlords	22
Bank of India	5
Farmer's cooperative bank	15
Money lenders	18
Bank of Allahabad	10
Friends and relatives	15
Maharashtra State Cooperative Bank	15

Based on the table given above which of the following statements are correct?

- I. Formal sources of credit are lower than informal sources.
- II. Informal sources of credit are lower than formal sources.
- III. One-fifth of debtors borrowed from friends and relatives.
- IV. Money lenders and landlords continue to be major sources of credit in the village.

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

Ans. (2)

Sol. Informal sources – $22 + 18 + 15 = 55$
 Formal sources – $5 + 15 + 10 + 15 = 45$

96. Dhanno gets up in the morning and milks her cow. She sells milk to three houses. She then cooks food for her family, and prepares her children for school. At 10 a.m., she goes to the market with vegetables from her garden and sells it. By 11.30 a.m. she goes to Simranjeet's house and cooks food for Simranjeet's family. At 2.00 p.m. she goes to Harpreet's house and washes clothes. By 5.00 pm she goes home and washes her family's clothes.

Identify the economic activities performed by Dhanno.

- I. Getting her children ready for school
- II. Cooking food for her family
- III. Cooking for Simranjeet's family
- IV. Washing her family's clothes
- V. Washing Harpreet's clothes
- VI. Selling vegetables
- VII. Selling milk

- (1) I, III, IV and VI (2) II, V, VI and VII (3) I, II, III and V (4) III, V, VI and VII

Ans. (4)

Sol. Getting her children ready for school
 Cooking food for her family
 Washing her family's clothes

Above activities are not counted as economic activities as they are performed for self consumption / production.

97. Himmatveer has inherited land and Rs. 2,50,000 from his father. He decided to build a factory on the land. He spent Rs. 2,00,000 for the building. To purchase the machines he took a loan of Rs. 75,000 from the bank and purchased machines. After six months, he could start production. He used the rest of the money that he has inherited to purchase the raw materials required. His fixed capital and the working respectively are :

- (1) Rs. 2,00,000 and Rs. 50,000 (2) Rs. 2,75,000 and Rs. 50,000
 (3) Rs. 50,000 and Rs. 2,00,000 (4) Rs. 50,000 and Rs. 2,75,000

Ans. (2)

Sol. 2,00,000 for building would be counted as fixed capital.
 75,000 for machine would be counted as fixed capital.
 50,000 for raw material would be counted as working capital.

98. Based on the given table, arrange the following households in the order of the most poor to the least poor.

Name of Head of House hold	Location of residence	Daily wage	No. of work days per person	Size of the house hold	No. of working members
Jeewan	Mumbai	100	15	7	2
Yashwant	Palampur Village	80	25	3	3
Sheelam	Bangalore	100	25	4	3
Sumer	Dindori Village	100	15	6	2

(1) Yashwant, Sumer, Sheelam, Jeewan

(2) Sheelam, Yashwant, Jeewan, Sumer

(3) Jeewan, Sumer, Sheelam, Yashwant

(4) Sumer, Sheelam, Yashwant, Jeewan

Ans. (3)

Sol. The average income of the families per month are as follow.

$$\text{Jeewan} - \frac{100 \times 15 \times 2}{7} = 428.57$$

$$\text{Sumer} - \frac{100 \times 15 \times 2}{6} = 500$$

$$\text{Sheelam} - \frac{100 \times 25 \times 3}{4} = 1875$$

$$\text{Yashwant} - \frac{80 \times 25 \times 3}{3} = 2000$$

99. The following data are given according to the Economic Survey 2012-13.

	Life Expectancy at birth (2006-10) (in years)	Infant Mortality rate (2011) (Per 1000 Live births)	Death Rate (Per 1000)
Odisha	63.0	57	8.5
Rajasthan	66.5	52	6.7
West Bengal	69.0	32	6.2
Maharashtra	69.9	25	6.3

Which alternative shows the states with descending order of health indicators ?

(1) Maharashtra, West Bengal, Rajasthan, Odisha

(2) Maharashtra, West Bengal, Odisha, Rajasthan

(3) West Bengal, Maharashtra, Rajasthan, Odisha

(4) Odisha, Maharashtra, West Bengal, Rajasthan

Ans. (1)

Sol. Maharashtra is good in all health indicators as its life expectancy is more than all the other states and its infant mortality rate is less than all the other states.

100. Economic tools and their relevant objectives are as follows :

Tools :	A. Issue Price
	B. Minimum Support Price
Objectives :	I. To create more buffer stock
	II. To reduce malnutrition in India
	III. To encourage farmers to produce more food grains
	IV. To distribute food grains in deficit areas and among poor families

Which alternatives gives correct combination of tools and their objectives :

(1) A – I and II, B – III and IV

(2) A – II and IV, B – I and III

(3) A – I and III, B – II and IV

(4) A – I and II, B – II and IV

Ans. (2)

Sol. In option (2) all are correctly matched.
