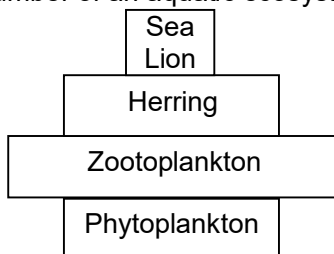


FIITJEE

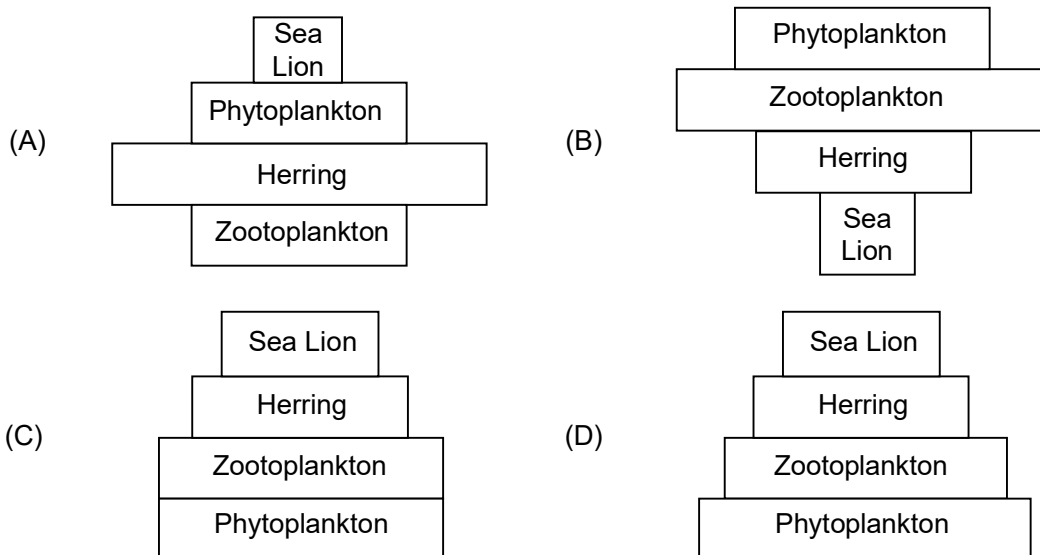
NTSE STAGE II CODE: 13 – 15 (2019 – 2020) SCHOLASTIC APTITUDE TEST Held on: February 14, 2021

BIOLOGY

- 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.
 - Chordata
 - Nematoda
 - Coelenterata
 - Echinodermata
- 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?
 - $\frac{1}{32}$
 - $\frac{1}{64}$
 - $\frac{1}{128}$
 - $\frac{1}{256}$
- Which one of the four methods of propagation is likely to lead to maximum variation in DNA sequence through generations?
 - Budding in *Hydra*
 - Binary fission in *Amoeba*
 - Reproduction in human beings
 - Vegetative propagation of sugarcane
- A case of bio-magnification was being studied. A laboratory received equal quantities of three samples M, N and O. The levels of pesticides found in these samples are as follows: **M–1 mg, N– 0.2 mg, O – 3mg.**
The samples M, N and O respectively could be:
 - Grass, grasshoppers and adipose tissue of birds
 - Grasshoppers, grass and adipose tissue of birds
 - Grass, adipose tissue of birds and grasshoppers
 - Adipose tissue of birds, grasshoppers and grass
- Illustration of a pyramid of number of an aquatic ecosystem is given.

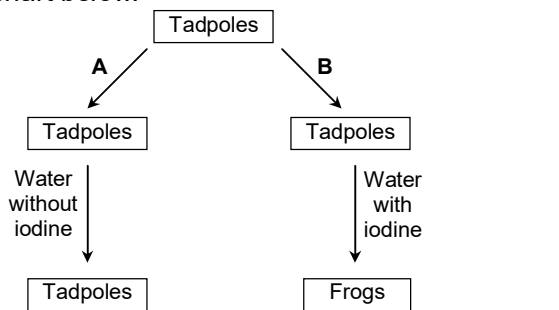


The pyramid of energy for the same ecosystem would be:



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, slipper 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
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.
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 ensuring probable effect on the egg are 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 to treatment which one of the options will be correct?
1. I and II
 2. I and IV
 3. II and III
 4. III and IV

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

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

Test tube – A	Test tube – B	Test tube – C
Saliva + Iodine ↓ incubation	Starch + Saliva ↓ incubation	Starch + Saliva + Enzyme Inhibitor ↓ Incubation + Iodine

What would be the colour observed in test tube 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

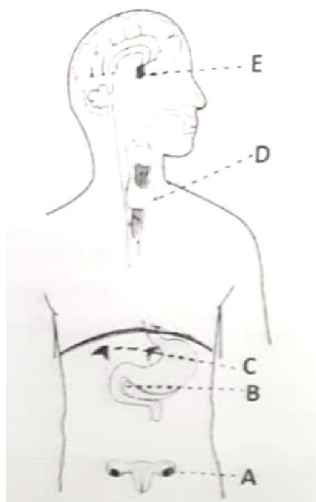
11. The presence of specific molecule (called markers) in an organelle can be used to identify the presence of that organelle. A researcher has three test tubes with organelles A, B and C, each of which shows the presence of one marker as shown below:

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 – Rough Endoplasmic Reticulum (RER); C – Lysosomes
3. A – Mitochondria; B – Smooth Endoplasmic Reticulum (SER); C – Golgi apparatus
4. A – Plastids; B – Smooth Endoplasmic Reticulum (SER); C – Golgi apparatus

12. Positions of endocrine glands are labeled A – E in the given diagram. Match the symbols of glands in column I 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

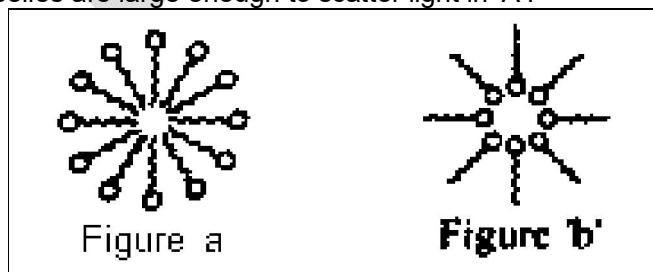
Choose the correct combination from the following:

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
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.

CHEMISTRY

14. 1.80 g of glucose($C_6H_{12}O_6$) was dissolved in 36 g of 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}

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
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
17. 100 mL of solution containing 0.1 mole of NaOH per litre was mixed with 100 mL solution containing 0.02 mole of H₂SO₄ 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
18. On oxidation with alkaline KMnO₄ 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
19. Atomic number of an element Z is 16. Element Z has two isotopes Z₁ and Z₂ with 16 and 18 neutrons, respectively. The average atomic mass of a sample of the element Z is 32.1 μ. Which one of the following percentage of Z₁ and Z₂ in the sample is correct?
- | | | |
|----|----------------|----------------|
| | Z ₁ | Z ₂ |
| 1. | 95% | 5% |
| 2. | 94% | 6% |
| 3. | 93% | 7% |
| 4. | 92% | 8% |
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 experiment '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'.



Correct observations are

- | | |
|---------------------|----------------------|
| 1. I, II & III only | 2. I, II & IV only |
| 3. I, III & IV only | 4. II, III & IV only |

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 statements is/are correct?

- I. 'A' is CH_3COOH
 - II. 'B' is CH_3CH_2OH
 - III. 'C' is $CH_3COOCH_2CH_3$
 - 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

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?

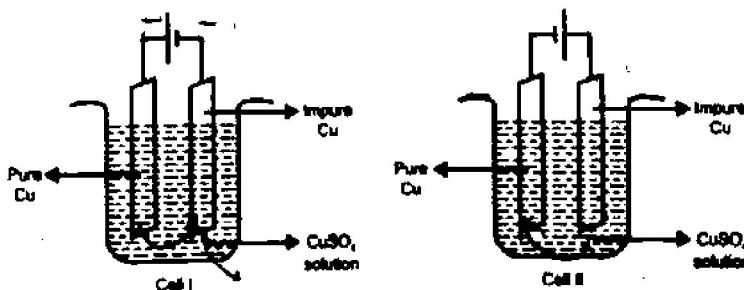
- 1. Sodium hydroxide + Acetic acid
- 2. Potassium hydroxide + Sulphuric acid
- 3. Ammonium hydroxide + Sulphuric acid
- 4. Sodium hydroxide + Hydrochloric acid

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	16	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
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

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 statements?

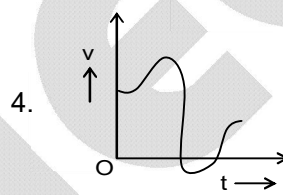
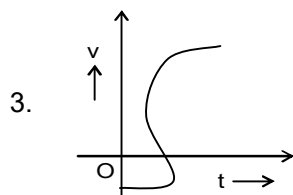
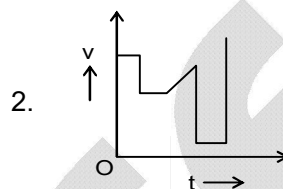
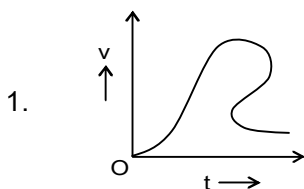
- | | |
|---------------------|---------------------|
| 1. I, II & III only | 2. I, III & IV only |
| 3. II & III only | 4. III & IV only |

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'.

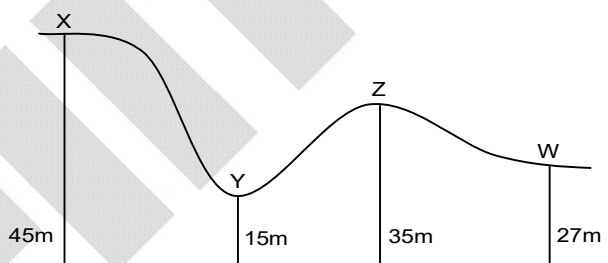
- | | |
|---|---|
| 1. CaSO_4 , CaCO_3 , gypsum | 2. CaSO_4 , CaHCO_3 , lime |
| 3. CaCO_3 , CaHCO_3 , CaSO_4 | 4. CaHCO_3 , CaCO_3 , CaSO_4 |

PHYSICS

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

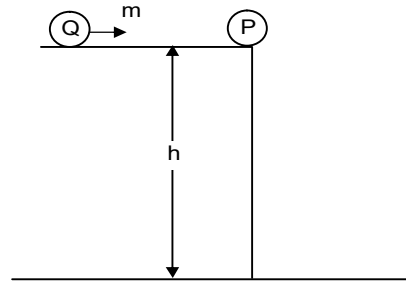


28. Two balls A and B are released towards point W from point X and point Z respectively, on a perfectly smooth track as shown in the figure. The balls move along the track without losing contact. What will be the ratio of their speeds (v_A/v_B) at point W?



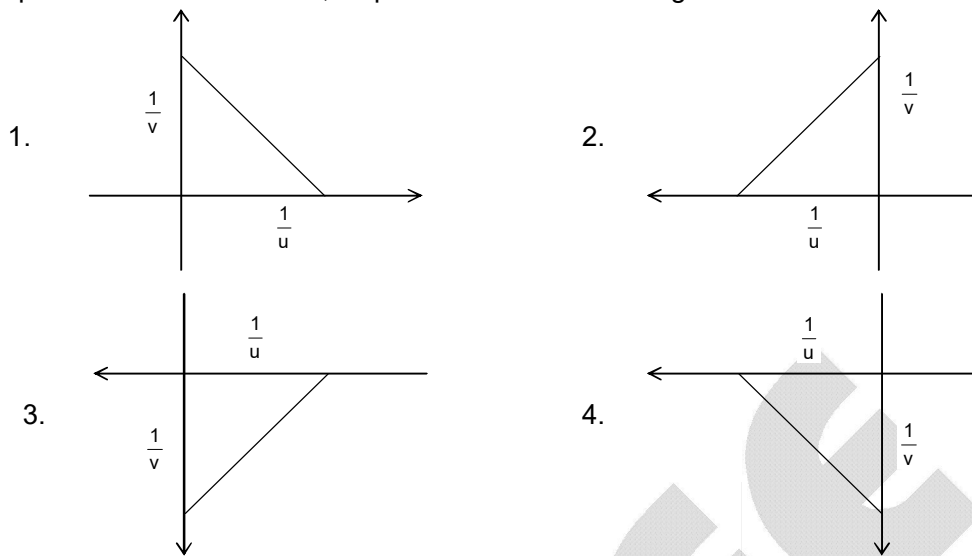
- | | |
|------------------|------------------|
| 1. 1 | 2. $\frac{1}{2}$ |
| 3. $\frac{2}{3}$ | 4. $\frac{3}{2}$ |

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



1. 0
2. $\frac{1}{2}u$
3. U
4. 2u
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. $\eta_M = \frac{1}{\sqrt{6}}\eta_E$
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. In 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
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. $\left(\frac{u}{g}\right)$
3. $\sqrt{2}\left(\frac{u}{g}\right)$
4. $2\left(\frac{u}{g}\right)$
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. $2.0 \times 10^6 \text{ N/m}$
34. A girl drops a ball from a height $h = 20 \text{ m}$. It strikes the ground elastically and returns to her hand. An echo of the thud of the ball striking the ground is produced from a 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 girls is close to
1. 350 m
2. $350\sqrt{2} \text{ m}$
3. 700 m
4. 3500 m

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



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 images, 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. $AB = 2f$

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?

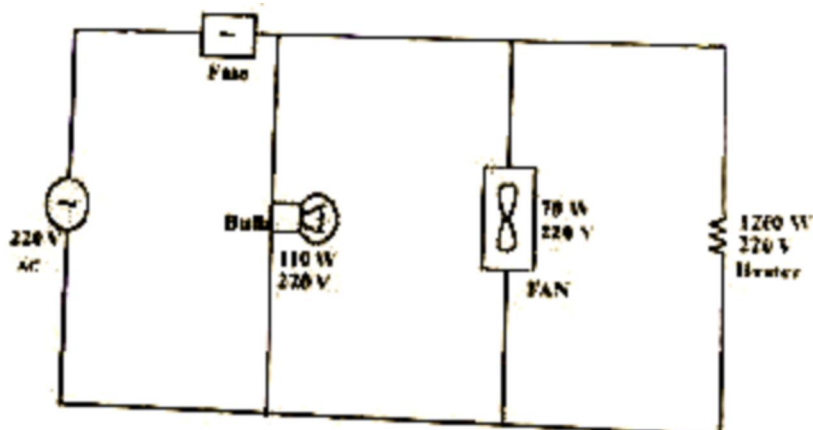
- I. She suffers from myopia where the far point is nearer than the blackboard.
- II. A concave lens with a suitable power can help correct her vision.
- III. Her eye is defective and is forming images in front of the retina.
- IV. A concave lens or a convex lens may be used to correct her vision.

1. Only I
2. I, II and III
3. I, II and IV
4. Only IV

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 .

39. Figures 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
40. A positively charged plate and negatively charged plate are kept parallel to each other at a distance of 10 cm. An electron is release 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

MATHEMATICS

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. $\frac{15 - \sqrt{10}}{47}$
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. both 9 and 11
4. neither 9 nor 1
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
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

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. $\frac{100R - 45}{41}$

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. $\frac{9}{8}$

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. $\frac{1}{39}$

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. $\frac{181}{4}\pi - 40$

49. The coordinates of point 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. $\frac{9}{10}$

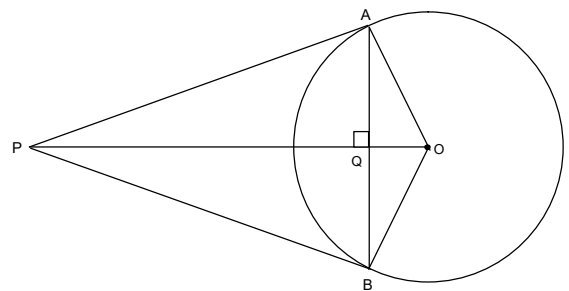
50. Two tangents PA and PB are drawn to a circle with centre O from an external point P. The chord AB intersects the line segment PO at Q. Then, the square of the radius of the circle is

1. $OQ \times QP$

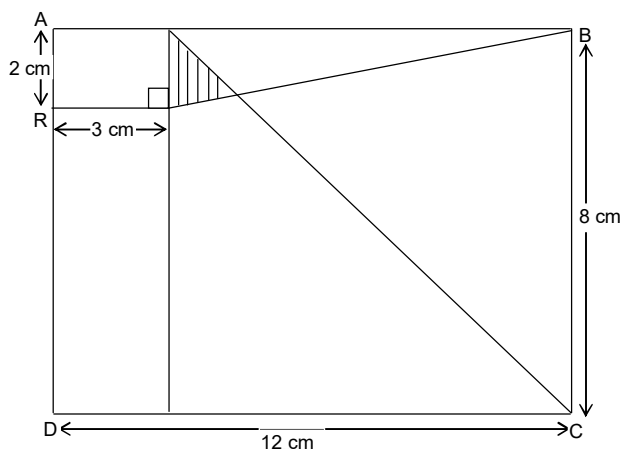
2. $OQ \times OP$

3. $PQ \times AB$

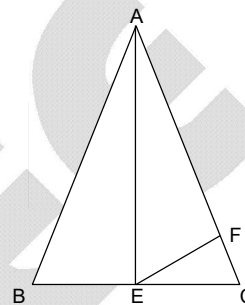
4. $PA \times PB$



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



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°



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
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
55. The largest possible area of $\triangle ABC$ 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
56. If $u = \cos\theta \left(\sin\theta + \sqrt{\sin^2\theta + \sin^2\alpha} \right)$ then $|\mu|$ 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. $\sqrt{2 + \cos^2\alpha}$

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. $\sqrt{\frac{3(b^2 - a)^2}{2}}$
 4. $\sqrt{\frac{3(a^2 - b)^2}{2}}$
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. $\frac{32}{\sqrt{5}} \text{ cm}^2$
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 number is
1. 625
 2. 650
 3. 675
 4. 725
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 ix closest to
1. 64.2
 2. 72.4
 3. 95.5
 4. 96.3

SOCIAL SCIENCE

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
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 construct a radically socialist society
1. I, II and III
 2. I, II and IV
 3. I, III and IV
 4. II, III and IV

63. Which of the following statements about Maasais are correct?
 I. Maasaic are found in Tanzania and Kenya
 II. Samburu National Park is situated in Tanzania
 III. The title Maasai is derived from word 'maa' which means 'my land'
 IV. Maasai land was taken away by not only British Kenya, but also GermanTanganyika
 1. I and II
 2. I and IV
 3. I, II and III
 4. II, III and IV
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
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 and III is false
 3. II and III are true and I is false
 4. I and III are true and II is false
66. In the light of political development 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
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 a 'new conservatism'. It then traveled to the former kingdom of Sardinia-piedmont, followed by a visit to the country once 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
68. Nationalism in India which emerged as a force in the late nineteenth century meant strong devotion for
 1. all counties 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

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 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. Increase in population – rising food prices – scarcity of grains – food riots – inability of the poor to buy bread.
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

Directions (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 statements are true and Statement–II provides explanations to Statement–I
 4. Both statements are true and Statement–II does not provides explanations to Statement–I
71. **Statement-I:** During the Civil Disobedience Movement, ‘no rent’ campaign were carried out in most placed.
Statement-II: The relationship between the poor peasants and the Congress remained uncertain.
72. **Statement-I:** Mahatma Gandhi successfully organized the Satyagraha movement of 1916 and 1917 in favour of peasants.
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.
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.
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.
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.
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

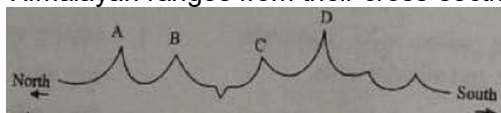
77. Geological structure, physiography and precipitation regimes influence evolution of drainage patterns. India with its diversity in the above mentioned attributes showcases a variety of drainage patterns across regions. Match the following drainage patterns found in the regions given below:

Drainage Patterns	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
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 |
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 |
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 |
81. Different types of soils are found in India having special characteristics 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 |
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, Chotanagar 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 |

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

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.



- A = Karakoram; B = Zaskar; C = Ladakh; D = Himadri
 - A = Zaskar; B = Karakoram; C = Himadri; D = Ladakh
 - A = Karakoram; B = Ladakh; C = Zaskar; D = Himadri
 - A = Zaskar; B = Himadri; C = Ladakh; D = Karakoram
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?
- The Beas flows into Pakistan and joins Sutlej.
 - Sutlej and Indus are examples of antecedent drainage.
 - River Luni drains into Sambar Lake which is an example of inland drainage.
 - The rivers flowing from the western slopes of Western Ghats are swift and have a short course.
- I and III
 - I, II and III
 - II and III
 - II, III and IV

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

- A – II, B – V, C – I, D – III
 - A – III, B – IV, C – I, D – II
 - A – III, B – I, C – IV, D – II
 - A – II, B – IV, C – III, D – V
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?
- Spain, Pakistan and South Africa are examples of a federal system.
 - Holding together federations always give equal power to its constituent units.
 - The jurisdiction and authority of each tier of government is constitutionally mandate.
 - For a dispute relating to division of powers it is the High Courts and Supreme Court of India which interpret the Constitution.

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

- A. Announcement of election schedule
- B. Election Campaign
- C. Making of voters' 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

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 Indian National Congress and the Muslim League.
- 4. Nominated by the Government for their expertise on constitutional matters.

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

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 statement/s given above is/are correct?

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

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

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 grains production in our country.
 3. **Veda:** Penalise the persons whose waste food grains in our country.
 4. **Zara:** Provide free food grains to all people below poverty line in our 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 |

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
Farmers' 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 |

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 p.m. 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 |

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

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 Household	Location of Residence	Daily Wages	No. of work days per person	Size of the household	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

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

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 alternative 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

FIITJEE

NTSE STAGE II
CODE: 13 – 15 (2019 – 2020)
SCHOLASTIC APTITUDE TEST
Held on: February 14, 2021

HINTS & SOLUTIONS

BIOLOGY

1.	4	2.	4	3.	3	4.	2
5.	4	6.	4	7.	1	8.	3
9.	1	10.	1	11.	2	12.	1
13.	2						

CHEMISTRY

14.	4	15.	3	16.	1	17.	2
18.	1	19.	1	20.	2	21.	2
22.	1	23.	4	24.	4	25.	1
26.	3						

PHYSICS

27.	4	28.	4	29.	3	30.	3
31.	2	32.	3	33.	3	34.	1
35.	2	36.	1	37.	4	38.	3
39.	4	40.	2				

MATHEMATICS

41.	3	42.	1	43.	4	44.	1
45.	3	46.	2	47.	2	48.	3
49.	2	50.	2	51.	4	52.	2
53.	4	54.	No Option Correct			55.	2
56.	1	57.	1	58.	1	59.	2
60.	4						

SOCIAL SCIENCE

61.	3	62.	1	63.	2	64.	4
65.	2	66.	1	67.	1	68.	2
69.	1	70.	1	71.	4	72.	3
73.	3	74.	1	75.	3	76.	2
77.	3	78.	4	79.	3	80.	1
81.	2	82.	4	83.	1	84.	3
85.	1	86.	3	87.	2	88.	4
89.	2	90.	4	91.	4	92.	2
93.	1	94.	4	95.	2	96.	4
97.	2	98.	3	99.	1	100.	2

BIOLOGY

1. 4

Sol. Specimen belongs to echinodermata phylum.

2. 4

Sol. $AaBbCcddEe \times AabbCcDdEe$

(1) $Aa \times Aa$

AA Aa Aa (aa)

$$Aa = \frac{1}{4}$$

(2)

$Bb \times bb$

Bb Bb (bb) bb

$$bb = \frac{2}{4}$$

(3)

$Cc \times Cc$

CC Cc Cc (cc)

$$cc = \frac{1}{4}$$

(4)

$dd \times Dd$

Dd (dd) Dd (dd)

$$dd = \frac{2}{4}$$

(5)

$Ee \times Ee$

EE Ee Ee (ee)

$$ee = \frac{1}{4}$$

$$\therefore \frac{1}{4} \times \frac{1}{2} \times \frac{1}{4} \times \frac{1}{2} \times \frac{1}{4} = \frac{2}{1024} \Rightarrow \frac{1}{256}$$

3. 3

Sol. Sexual reproduction leads maximum variation in DNA sequence through generation.

4. 2

Sol. M = 1 mg, → Grass hopper

N = 0.2 mg, → Grass

O = 3mg → Adipose tissues of birds

MNO

Grasshopper, Grass, adipose tissue of bird

5. 4

Sol. Pyramid of energy for every ecosystem is upright.

6. 4

Sol. Human arm, seal forelimb and wings of a bird are homologous organs and they show divergent evolution.

7. 1
Sol. Farmer B performed the practice of mixed cropping. Mixed cropping reduces risk and gives some insurance against failure of one of the crops.

8. 3
Sol. Egg shell is made up of calcium carbonate when it kept in HCl it reacts with CaCO_3 and dissolves the shell.

9. 1
Sol. Iodine helps to produce thyroxine, which is important for metamorphosis.

10. 1
Sol.

Test tube – A	Test tube – B	Test tube – C
Saliva + Iodine ↓ incubation	Starch + Saliva ↓ incubation	Starch + Saliva + Enzyme Inhibitor ↓ Incubation + Iodine
Yellow colour	No colour	Blue black colour

* iodine is camel brown in colour

* When iodine reacts with starch gives blue black colour

11. 2
Sol. Test tube A – Mitochondria
Test tube B – Rough Endoplasmic Reticulum (RER)
Test tube C – Lysosome

12. 1
Sol.

Column 1		Column 2	
A.	Ovary	I.	Progesterone
B.	Pancreas	II.	Insulin
C.	Adrenal gland	VIII.	Aldosterone
D.	Parathyroid	III.	Parathyroid hormone
E.	Pituitary gland	V.	Follicle stimulating hormone

13. 2
Sol. Antibiotics helped in the selection for bacterium with mutations in the DNA conferring drug resistance which were already present in the population.

CHEMISTRY

14. 4

Sol. Number of moles of glucose = $\frac{1.80}{180} = 10^{-2}$ moles

Number of molecules of glucose = $10^{-2} \times 6.022 \times 10^{23} = 6.022 \times 10^{21}$ molecules of glucose
 Total number of O – atom present in glucose = $6 \times 6.022 \times 10^{21}$

Number of moles of water = $\frac{36}{18} = 2$ moles

Number of H₂O molecule = $2 \times 6.022 \times 10^{23}$ molecule

∴ No. of O atom in water = 12.044×10^{23}

Total number of O – atom present in solution = $12.044 \times 10^{23} + 36.138 \times 10^{21}$
 = 12.40×10^{23} oxygen atom

15. 3

Sol. F, Cl, N & O are electronegative element. In second period of periodic table the tendency of forming anion increase upto fluorine.

16. 1

Sol. Rate of evaporation \propto Temperature & wind speed

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

17. 2



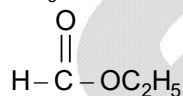
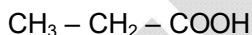
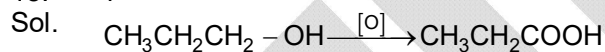
0.1 M 0.04 M

0.01 mole 0.004 mol

Mole of NaOH left = 0.006

∴ Amount of NaOH = $0.006 \times 40 = 0.24$

18. 1

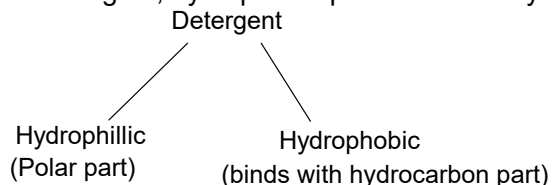


19. 1

Sol. Average atomic mass = $\frac{\sum (\% \text{ Abundance} \times \text{Isotopic mass})}{100}$

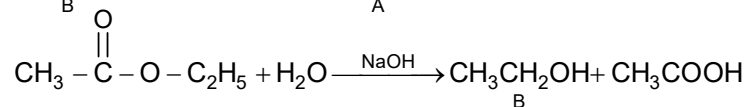
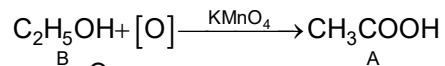
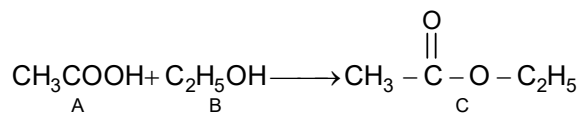
20. 2

Sol. In detergent, hydrophobic part bend with hydrocarbon part and hydrophilic part



21. 2

Sol.



22. 1

Sol. The solution of NaOH + CH_3COOH have pH more than 7.

S.B
W.A

23. 4

Sol. As we go in periodic table from left to right in period, atomic size decrease, so size of B is not smaller than K

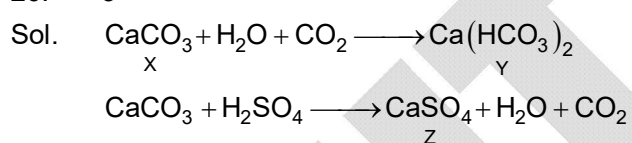
24. 4

Sol. When current is applied to electrochemical cell Cu(II) was in solution and reduced to Cu -atom at the cathode Cu -atom on the anode are oxidized in Cu(II) ions. The cathode gain mass, the anode loses mass

25. 1

Sol. The order of reactivity of metal is
 $Z > \text{Zn} > \text{Fe} > \text{Y} > \text{Cu} > \text{X}$

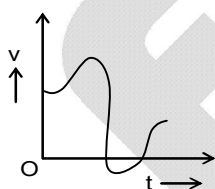
26. 3



PHYSICS

27. 4

Sol.



28. 4

Sol. Loss of PE = Gain in K.E.

$$\Rightarrow v = \sqrt{2gh}$$

$$\therefore \frac{v_A}{v_B} = \sqrt{\frac{h_A}{h_B}} = \sqrt{\frac{18}{8}} = \frac{3}{2}$$

29. 3

Sol. When two bodies of equal masses undergo elastic collision in one dimension, their velocities gets interchanged.

30. 3

Sol. Buoyant force = Weight of body (flotation)

$$V \times \rho_l \times g = M_b \times g$$

$$V \times \rho_l = M_b$$

Fraction remains same.

31. 2

Sol. Given, $mg_1 = 0.25 mg$

$$g_1 = \frac{g}{4}$$

$$\& \quad T = 2\pi\sqrt{\frac{L}{g}}$$

32. 3

Sol. $KE = PE = \frac{KE_{\max}}{2}$

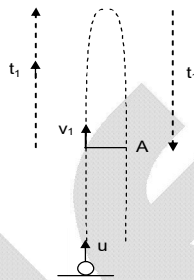
$$\frac{1}{2}mv_1^2 = \frac{1}{2}mu^2$$

$$v_1 = \frac{u}{\sqrt{2}}$$

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

Body will reach back to point A from maximum height in time t_1 .

$$\text{Total time interval} = 2t_1 = 2 \times \frac{u}{g} = \sqrt{2} \frac{u}{g}$$



33. 3

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

$$\frac{1}{2} \times 10 \times (10)^2 + 10 \times 10 \times \frac{5}{100} = \frac{1}{2} \times k \times \left(\frac{5}{100}\right)^2$$

$$k = 4 \times 10^5 \text{ N/m}$$

34. 1

Sol. Sound will be produced when ball hit ground

Time taken by ball to return is

$$t_A = \frac{u}{g} = \frac{20}{10} = 2\text{s}$$

$$\text{Distance of cliff } d = \frac{v \times t}{2} = 350 \text{ m.}$$

35. 2

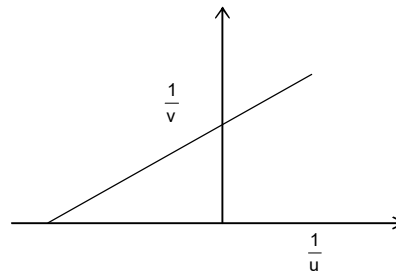
Sol. By sign conversion, for convex mirror

$$v = +ve \quad u = -ve \quad f = +ve$$

$$\frac{1}{f} = \frac{1}{v} = \frac{1}{u}$$

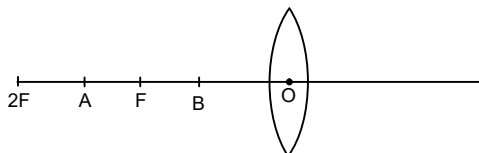
$$\frac{1}{v} = \frac{1}{u} + \frac{1}{f}$$

$$y = mx + c$$



36. 1

Sol.



$$m = \frac{f}{f + u}$$

$$\text{For } u = -AO$$

$$U = -BO$$

$$m = -ve$$

$$m = +ve$$

$$-m = \frac{f}{f - AO} \quad \& \quad m = \frac{f}{f - BO}$$

$$\frac{f}{f - AO} = -\frac{f}{f - BO}$$

$$f - BO = AO - f$$

$$2f = AO + BO$$

$$2f = (AF + OF) + (OF - BF)$$

$$2f = 2f + AF - BF$$

$$\Rightarrow AF = BF$$

37. 4

Sol.

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.

Statements I, II & III are correct.

38. 3

Sol.

For I_{\max}

R_{eq} should be minimum ($V = IR$)

To get minimum resistance least value resistor should be connected in series.

39. 4

Sol.

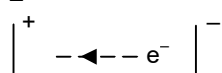
$$I_{\text{Bulb}} = \frac{110}{220} \text{ A} \quad I_{\text{fan}} = \frac{70}{220} \text{ A} \quad I_{\text{Heater}} = \frac{1200}{220} \text{ A}$$

$$I_{\text{fuse}} = I_{\text{Bulb}} + I_{\text{fan}} + I_{\text{Heater}} = 6.27 \text{ A}$$

Fuse wire should be 10 A.

40. 2

Sol.



When observed from -ve plate current is towards observer. Thus by RHTR magnetic field is anti-clockwise.

MATHEMATICS

41. 3

Sol. $x = \frac{\sqrt{5} - \sqrt{2}}{2\sqrt{3 + \sqrt{5}} - \sqrt{2}}$
 $\Rightarrow x = \frac{\sqrt{5} - \sqrt{2}}{2\left(\frac{\sqrt{5} + 1}{\sqrt{2}}\right) - \sqrt{2}}$ (Since $\sqrt{3 + \sqrt{5}} = \frac{\sqrt{5} + 1}{\sqrt{2}}$)
 $\Rightarrow x = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{10}} \Rightarrow x\sqrt{10} = \sqrt{5} - \sqrt{2}$
So, $\frac{x\sqrt{10} + \sqrt{2}}{x\sqrt{10} + 2\sqrt{5}} = \frac{\sqrt{5}}{3\sqrt{5} - \sqrt{2}} = \frac{15 + \sqrt{10}}{43}$

42. 1

Sol. $x = 17q_1 + 9 = 11q_1 + 6q_1 + 9$
 $x - 9$ must be divisible by 11
 $\Rightarrow 11q_1 + 6q_1 + 9 - 9$ is divisible by 11
 $\Rightarrow 6q_1 + 9$ is divisible by 11
 $\Rightarrow q_1 = 10, 21, 32, \dots$
For $q_1 = 21$, x lies between 300 and 400
So, $x = 17 \times 21 + 9$
 $= 366$
Remainder where 366 is divided by 21 is 9.

43. 4

Sol. By long division
 $(ax + b)(x^5 + 1) - (5x + 1) = (x^2 + 1)(ax^4 + bx^3 - ax^2 - bx + a)$
 $+ (a + b - 5)x + (b - a - 1)$
Taking remainder = 0
We get $a + b = 5$ and $-a + b = 1$
On solving we get $a = 2$, $b = 3$
So, $2a + 3b = 13$

44. 1

Sol. Intersection point of $15x + 20y = -2$ and $x - y = -2$ is $x = \frac{-6}{5}$, $y = \frac{4}{5}$

$$\text{Now } 2\left(-\frac{6}{5}\right) + 3\left(\frac{4}{5}\right) = k^2$$

$$\Rightarrow k^2 = 0 \Rightarrow k = 0$$

So, k is an integer

45. 3

Sol. $(a_{13} - a_3)^2 = a_{13}^2 + a_3^2 - 2a_{13}a_3$
 $\Rightarrow (10d)^2 = 5 - 2a_{13}a_3$
 $\Rightarrow d^2 = \frac{5 - 2a_{13}a_3}{100}$

$$\text{Now } a_4 \times a_{12} = (a_3 + d) \times (a_{13} - d)$$

$$\Rightarrow R = a_3 a_{13} + d(a_{13} - a_3) - d^2$$

$$\Rightarrow R = a_3 a_{13} + 9d^2$$

$$\Rightarrow R = a_3 a_{13} + 9 \left[\frac{5 - 2a_{13}a_3}{100} \right]$$

$$\Rightarrow a_{13}a_3 = \frac{100R - 45}{82}$$

46. 2

Sol. α, β are roots of $2x^2 - 5x - 6 = 0$

$$\Rightarrow 2\alpha^2 - 5\alpha - 6 = 0 \Rightarrow \alpha^2 - 3 = \frac{5\alpha}{2}$$

$$\text{Similarly, } \beta^2 - 3 = \frac{5\beta}{2}$$

$$\text{Now, } \frac{P_9 - 3P_7}{4P_8} = \frac{(\alpha^8 - \beta^8) - 3(\alpha^6 - \beta^6)}{4(\alpha^7 - \beta^7)}$$

$$= \frac{\alpha^6(\alpha^2 - 3) - \beta^6(\beta^2 - 3)}{4(\alpha^7 - \beta^7)}$$

$$= \frac{\frac{5}{2}[\alpha^7 - \beta^7]}{4[\alpha^7 - \beta^7]} = \frac{5}{8}$$

47. 2

Sol. Total numbers = 1000

Now numbers of form m^n are either perfect square or perfect cube or of form m^5 or m^7

Now, for $n = 2$, m can take 30 values

for $n = 3$, m can take 7 values (excluding 64 and 729 as these are counted in perfect square)

for $n = 5$, m can take 2 values

for $n = 7$, m can take 1 value

Total	40
-------	----

$$\text{Probability} = \frac{40}{1000} = \frac{1}{25}$$

48. 3

Sol. A (-5, 5), B (4, -5), C (4, 5)

By distance formula

$$AB = \sqrt{181}$$

$$BC = 10$$

$$AC = 9$$

$$\text{Since } AB^2 = BC^2 + AC^2$$

$$\Rightarrow \text{ABC is right angled triangle and } \angle C = 90^\circ, \text{ hypotenuse} = \sqrt{181}$$

$$\text{Radius of circum circle} = \frac{\sqrt{181}}{2}$$

So, required area

$$= \pi \left(\frac{\sqrt{181}}{2} \right)^2 - \frac{1}{2} \times 10 \times 9$$

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

49. 2

Sol. B' (-3, 1) is image of B (3, 1) in y-axis

Now $\triangle CB'D \cong \triangle CBD$

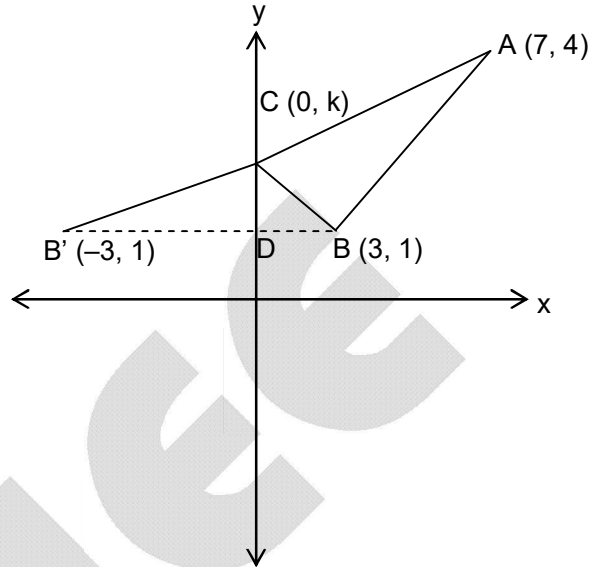
$\Rightarrow CB = CB'$ (CPCT)

Since $CB + CA$ is minimum

$\Rightarrow CB' + CA$ is also minimum which is possible when B', C and A are collinear

\Rightarrow Slope of B' C = Slope of AB'

$$\Rightarrow \frac{k-1}{3} = \frac{3}{10} \Rightarrow k = \frac{19}{10}$$



50. 2

Sol. $\triangle OQA \sim \triangle OAP$

$$\Rightarrow \frac{OQ}{OA} = \frac{OA}{OP} \Rightarrow OA^2 = OQ \times OP$$

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

51. 4

Sol. $\triangle PXQ \sim \triangle CXB$

$$\therefore \frac{XM}{XN} = \frac{PQ}{BC} = \frac{1}{4}$$

$$XM + XN = 9$$

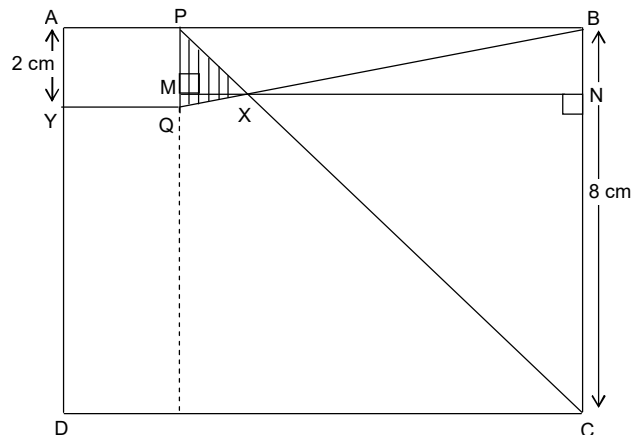
$$\Rightarrow 5 \times XM = 9$$

$$\Rightarrow XM = \frac{9}{5} \text{ cm}$$

$$\text{area } (\triangle PXQ) = \frac{1}{2} \times PQ \times XM$$

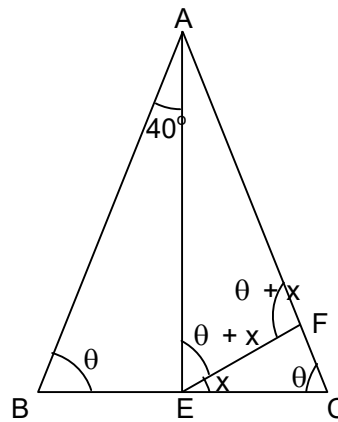
$$= \frac{1}{2} \times 2 \times \frac{9}{5}$$

$$= 1.8 \text{ cm}^2$$



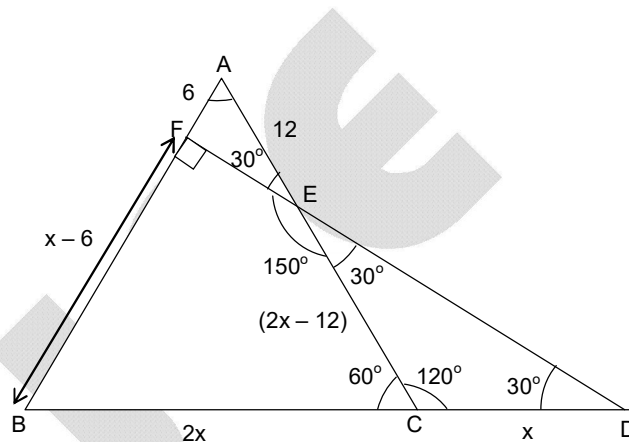
52. 2

Sol. Let $\angle ABC = \angle ACB = \theta$ and $\angle CEF = X$
 then $\angle AFE = \angle AEF = \theta + X$
 Now by exterior angle property
 $\angle AEC = \angle ABE + \angle BAE$
 $\Rightarrow \theta + 2x = 40 + \theta \Rightarrow x = 20^\circ$



53. 4

Sol. $AF = 6 \Rightarrow AE = 6 \operatorname{cosec} 30^\circ = 12$
 $\Rightarrow AC = 2x - 12$ and
 $\angle CDE = \angle CED \Rightarrow CE = CD$
 $\Rightarrow 2x - 12 = x \Rightarrow x = 12$
 $BF = 2x - 6 = 18$



54. **No Option Correct**

Sol. When water level rise 15 cm then radius of top surface of water level = $\frac{20 + 10}{2} = 15$ cm

$$\text{Required time} = \frac{\frac{1}{3} \pi [15^2 + 10^2 + 15 \times 10] \times 15}{\pi \times 5 \times 5 \times 10}$$

= 9.5 minutes

55. 2

Sol. $S = 6$

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

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

$$= \sqrt{-6a^2 + 42a - 36}$$

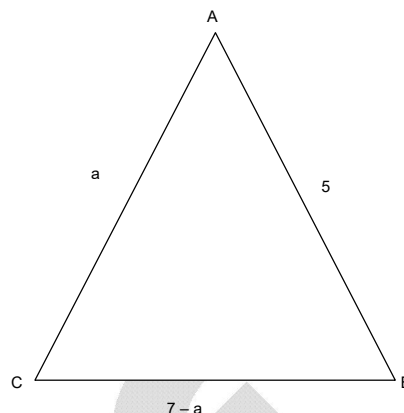
$$\Delta_{\max}^2 = \frac{-D}{4a}$$

$$= \frac{75}{2}$$

$$\Delta_{\max} = \sqrt{\frac{75}{2}}$$

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

$$= \frac{5}{2} \sqrt{6}$$



56. 1

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

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

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

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

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

$$\tan \theta \in \mathbb{R}, D \geq 0$$

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

$$4u^2(1 - u^2 + \sin^2 \alpha) \geq 0$$

$$u^2 \leq 1 + \sin^2 \alpha$$

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

57. 1

Sol. Let PQ be the tower.

$$\tan 45 = \frac{PQ}{AQ}$$

$$\Rightarrow PQ = AQ = x \text{ (say)}$$

$$\tan 30 \Rightarrow \frac{PQ}{BQ} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow BQ = \sqrt{3}x$$

$$\text{Now, } OA^2 + AQ^2 = BQ^2 + DB^2$$

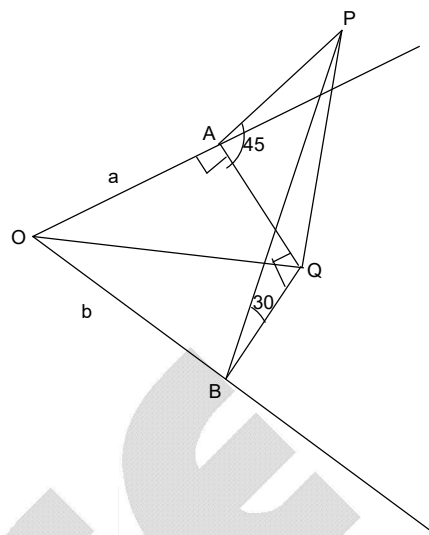
$$a^2 + x^2 = 3x^2 + b^2$$

$$2x^2 = a^2 - b^2$$

$$x^2 = \frac{a^2 - b^2}{2}$$

$$PQ^2 = x^2 = \frac{a^2 - b^2}{2}$$

$$PQ = \sqrt{\frac{a^2 - b^2}{2}}$$



58. 1

Sol. $PB = \sqrt{4^2 + 8^2} = \sqrt{80} = 4\sqrt{5} \text{ cm}$

$$\text{ar}(\triangle PCB) = \frac{1}{2} \text{ar}(\square ABCD)$$

$$= \frac{1}{2} \times 64 = 32 \text{ sq. cm}$$

$$\therefore \frac{1}{2} \times PB \times CE = 32$$

$$\frac{1}{2} \times 4\sqrt{5} \times CE = 32$$

$$CE = \frac{16}{\sqrt{5}}$$

Also, $\triangle PAB \sim \triangle BEC$

$$\Rightarrow \frac{PA}{BE} = \frac{AB}{EC} = \frac{PB}{BC}$$

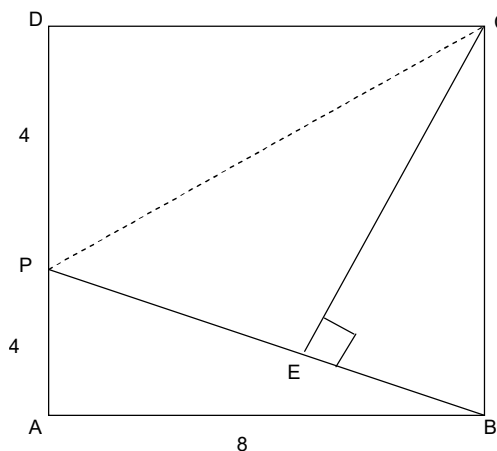
$$\Rightarrow \frac{4}{BE} = \frac{8 \times \sqrt{5}}{16} = \frac{4\sqrt{5}}{8}$$

$$\Rightarrow BE = \frac{8}{\sqrt{5}}$$

$$\therefore \text{ar}(\triangle BEC) = \frac{1}{2} \times CE \times BE$$

$$= \frac{1}{2} \times \frac{16}{\sqrt{5}} \times \frac{8}{\sqrt{5}}$$

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



59. 2

Sol. Let numbers are a, b and c

a is smallest and c is largest then median = 5 $\Rightarrow b = 5$

$$\text{also, } \frac{a+b+c}{3} = a+10 = c-15$$

$$\Rightarrow a = 0 \text{ and } c = 25$$

$$\text{So, } a^2 + b^2 + c^2 = 650$$

60. 4

Sol. Let radius of sphere A is a

radius of sphere B is b

$$\text{then } 4\pi b^2 = 4\pi a^2 + 8 \times 4\pi a^2$$

$$\Rightarrow \frac{a}{b} = \frac{1}{3} = \frac{k}{3k} \text{ (let)}$$

$$V_B - V_A = \frac{4}{3}\pi[(3k)^3 - (k)^3] = \frac{4}{3}\pi(26k^3)$$

$$\begin{aligned} \text{Required percentage} &= \frac{\frac{4}{3}\pi(26k^3)}{\frac{4}{3}\pi(3k)^3} \times 100 \\ &= 96.3\% \text{ (Approx)} \end{aligned}$$