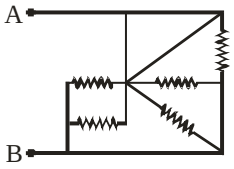
NATIONAL TALENT SEARCH EXAMINATION (NTSE-2020) STAGE -1

STATE : BIHAR PAPER : SAT

Date: 17/11/2019

Max. Marks: 100 **SOLUTIONS** Time allowed: 120 mins

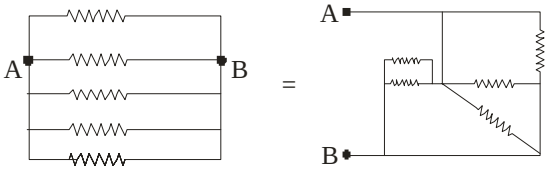
1. The circuit shown has 5 resistors of equal resistance R. Calculate equivalent resistances across points A and B.



(1) $\frac{11R}{12}$ (2) $\frac{13R}{12}$ (3) $\frac{R}{5}$ (4) $\frac{15R}{6}$

Ans. (3)

Sol.



$\therefore$ Req = $\frac{R}{5}\Omega$

2. For an object thrown at 45° to horizontal, the maximum height (H) and horizontal range (R) are related as :

(1) R = 16 H (2) R = 8 H (3) R = 4 H (4) R = 2 H

Ans. (3)

Sol. for maximum range

$R = \frac{u^2 \sin 2\theta}{g}$

$R = \frac{u^2 \sin 90°}{g}$

$R = \frac{u^2}{g}$

$\theta = 45°$

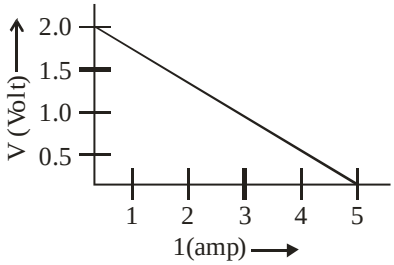
$2\theta = 90°$

$\sin 2\theta = \sin 90° = 1$

$$H = \frac{u^2 \sin^2(45)}{g} = \frac{u^2}{4g}$$

$\therefore$ $R = 4H$

3. For a cell, a graph is plotted between the potential difference V across the terminals of the cell and current I drawn from the cell (see fig.) the emf and internal resistance of the cell are E and r respectively, then :



(1) E = 2V, r = 0.5Ω (2) E = 2V, r = 0.4Ω

(3) E > 2V, r = 0.5Ω (4) E > 2V, r = 0.4Ω

Ans. (4)

Sol. $i = \frac{V}{R}$

$\therefore$ $R = \frac{V}{i}$

$= \frac{2}{5}$

$= 0.4\Omega$

$V = 2V$

$\therefore$ $E > 2V$

4. A simple pendulum has a time period T_1 when on the earth's surface and T_2 when taken to a height R above earth's surface, where R is the radius of the earth.

The value of ratio $\frac{T_2}{T_1}$ will be :

(1) 1 : 1 (2) $\sqrt{2}$: 1 (3) 4 : 1 (4) 2 : 1

Ans. (4)

Sol. $R_1 = R$

$R_2 = 2R$

$g_1 = \frac{GM}{R^2} = g$

$g_2 = \frac{GM}{(2R)^2}$

$= \frac{GM}{4R^2} = \frac{g}{4}$

$T_1 = 2\pi\sqrt{\frac{l}{g}} = T$

$T_2 = 2\pi\sqrt{\frac{l}{g/4}}$

$= 2.2\pi\sqrt{\frac{l}{g}}$

$= 2T$

$\frac{T_1}{T_2} = 2 : 1$

5. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius R with constant speed v. The time period of the motion :

(1) Depends on both R and v (2) Is independent of both R and v

(3) Depends on R but not on v (4) Depends on v but not on r

Ans. (2)

Sol. velocity, $v = \frac{2\pi R}{t} \Rightarrow t = \frac{2\pi R}{v}$ ....(i)

magnetic force = centripetal force

$Bqv = \frac{mv^2}{R} \Rightarrow v = \frac{BqR}{m}$ ....(ii)

after substituting value of v in eqution (ii)

$\boxed{t = \frac{2\pi m}{Bq}}$

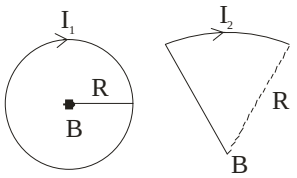
6. Two wires A and B have lengths 40 cm and 30 cm respectively. A is bent as a circle of radius r and B into an arc of radius r. A current I_1 is passed through A and I_2 through B. To have have same magnetic field at the centre, the ratio of $I_1 : I_2$ is

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

Ans. (1)

Sol. Given, l_1 = 40 cm, l_2 = 30 cm,

$R = \frac{40}{2\pi} l_2 = \phi R \Rightarrow \phi = \frac{l_2}{R} = \frac{30}{\left(\frac{40}{2\pi}\right)} = \frac{2\pi \times 3}{4}$



According to given

$B_1 = B_2$

$B_1 = \frac{\mu_0 I_1}{2R}$, $B_2 = \frac{\mu_0 I_2 . \phi}{4\pi R}$

$\Rightarrow \quad I_1 = \frac{I_2 . \phi}{2\pi} \quad \Rightarrow \frac{I_1}{I_2} = \frac{2\pi \times 3}{4 \times 2\pi} = \frac{3}{4}$

$\boxed{I_1 : I_2 = 3 : 4}$

7. A machine gun fires a bullet of mass 40 gram at a speed of 1200 ms^{-1}. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most ?

(1) One (2) Four (3) Two (4) Three

Ans. (4)

Sol. Given, F = 144N, m = 40 gm v = 1200 m/s

In 1 sec 'n' bullets will fine

then, $F = \frac{\Delta P}{t} \Rightarrow F = \frac{mv}{(1/n)} \Rightarrow F = n(mv)$

$\Rightarrow \quad 144 = n(40 \times 10^{-2} \times 1200)$

$\Rightarrow \quad \boxed{n = 3}$

8. A concave lens of focal length 30cm placed in contact with a plane mirror acts as a ;

(1) Convex mirror of focal length 60 cm

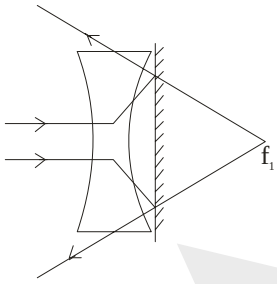
(2) Convave mirror of focal length 15 cm

(3) Convex mirror of focal length 15 cm

(4) Convave mirror of focal length 60 cm

Ans. (3)

Sol.



$\frac{1}{f_T} = \frac{1}{f_m} - \frac{2}{f_l} \Rightarrow \frac{1}{f_T} = \frac{2}{30}$

$\Rightarrow \quad \frac{1}{f_T} = \frac{1}{\infty} - \frac{2}{(-30)}$

$\boxed{f_T = 15cm}$

convex mirror of focal length 15 cm

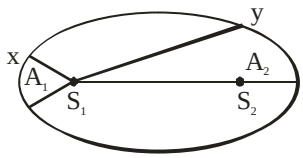
9. A comet orbits the sun in elliptical orbit. Which of the following is constant throughout its orbit ?

(1) Linear speed (2) Angular momentum

(3) Angular speed (4) Potential energy

Ans. (2)

Sol.



for any stable orbit

τ (torque) = 0

$\frac{dL}{dt} = 0$ (L = Angular momentum = mvr)

L = constant

Angular momentum is constant

10. Rainbow is formed due to a combination of :

(1) Dispersion and total internal reflection

(2) Refraction and absorption

(3) Dispersion and interference

(4) Scattering and dispersion

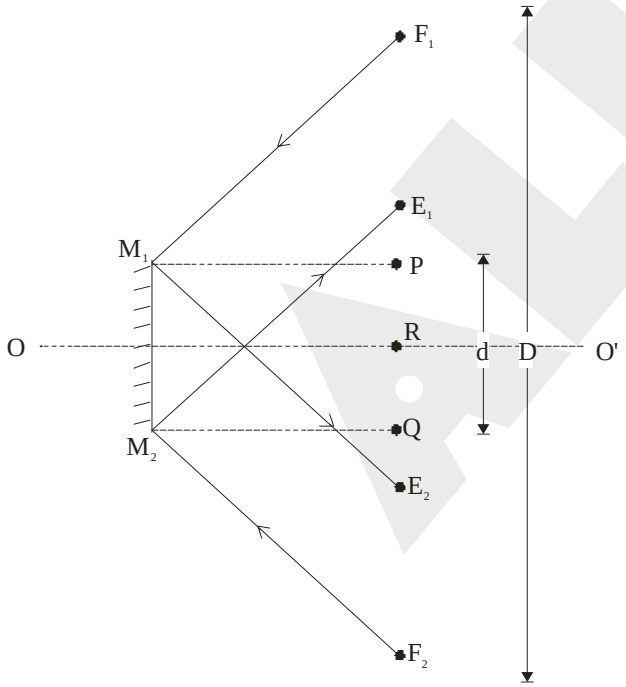
Ans. (1)

11. A person has D cm wide face and his two eyes are separated by d cm. the minimum width (in cm) of a mirror required for the person to view his complete face is :

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

Ans. (4)

Sol.



E_1E_2 = distance between Eye = d
F_1F_2 = distance between Ear = D
M_1M_2 = length of mirror = PQ
P = mid point of F_1E_2
Q = mid point of F_2E_1
from figure.
$M_1M_2 = F_1E_1$
OO' = centre line

$F_1R = \frac{D}{2}$

$E_1R = \frac{d}{2}$

$F_1E_1 = F_1R - E_1R$

$F_1E_1 = \frac{D}{2} - \frac{d}{2}$

we know

$F_1E_1 = M_1M_2 = \frac{D-d}{2}$

12. The horizontal range of a projectile is added maximum for a given velocityof projection when the angle of projection is :
(1) 30° (2) 60° (3) 45° (4) 90°

Ans. (3)

Sol. $R = \frac{u^2 \sin 2\theta}{g}$

for maximum range $\sin 2\theta = 1$
$2\theta = 90°$
$\theta = 45°$

13. Parsec is the unit of :
(1) distance (2) time (3) velocity (4) angle

Ans. (1)

14. Assertion : During digestion with concentrated H_2SO_4, nitrogen of the organic compound is converted into $(NH_4)_2SO_4$.
Reason : $(NH_4)_2SO_4$ on heating with alkali liberates NH_3 gas.
Read the assertion and reason carefully to mark the correct option.
(1) Both assertion and reason are ture and the reason is the correct explanation of the assertion.
(2) Both assertion and reason are true and the reason is not the correct explanation of the assertion.
(3) Assertion is true but the reason is false
(4) Assertion is false but the reason is true.

Ans. (2)

Sol. In kjeldahl procedure acter digestion in concentated sulfuric acid, total organic nitrogen is converted to ammonium. Sulfate ammonium sulfate give ammonia gas by reacting with sodium hydroxide.

15. The following is the correct decreasing order of the ionic radii -
(1) $K^+ > Ca^{2+} > S^{2-} > Cl^-$ (2) $K^+ > Ca^{2+} > Cl^- > S^{2-}$
(3) $Ca^{2+} > K^+ > Cl^- > S^{2-}$ (4) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

Ans. (4)

Sol. For an Isoelectronic series increasing in positive charge leads to decrease in size and increase in negative charge leads to increase in size.

16. The high density of water as compared to ice is due to
(1) Hydrogen bond interaction
(2) Dipole - dipole interaction
(3) Dipole - induced dipole interaction
(4) Induced dipole - induced dipole interaction

Ans. (1)

Sol. Due to polar nature water molecules are held together by intermolecular hydrogen bonds.

17. Equal volume of molar hydrochloric acid and sulphuric acid are neutralized by dilute NaOH solution and x Kcal and y Kcal of heat are liberated. Which of the following is ture ?

(1) x = y (2) $x = \frac{y}{2}$ (3) x = 2y (4) None of these

Ans. (2)

Sol. One mole of H^+ and OH^- release 57.1 kJ energy. In case of H_2SO_4, 2 mole of H^+ andOH^- ion will neutralize.

18. Propyne and propane can be distinguished by-
(1) Conc. H_2SO_4 (2) Br_2 in CC l_4 (3) dil $KMnO_4$ (4) $AgNO_3$ in ammonia

Ans. (2)

Sol. Br_2 in CCl_4
Bromine is used to distinguish saturated and unsaturated hydrocarbons

19. Identify the correct order of boiling points of the following compounds-
(A) $CH_3CH_2CH_2CH_2OH$
(B) $CH_3CH_2CH_2CHO$
(C) $CH_3CH_2CH_2COOH$
(1) (A) > (B) > (C) (2) (C) > (A) > (B)
(3) (A) >(C) > (B) (4) (C) > (B) > (A)

Ans. (2)

Sol. Because of higher molecular weight carboxylic acid has highest boiling point than alcohol and alcohol has higher boiling point than aldehyde.

20. Excess of KI reacts with $CuSO_4$ solution and then $Na_2S_2O_3$ solution is added to it. Which of the following statements is incorrect ?
(1) Cu_2I_2 is formed (2) CuI_2 is formed (3) $Na_2S_2O_3$ is oxidised (4) Evolved I_2 is reduced

Ans. (2)

Sol. $CuSO_4 + KI \rightarrow Cu_2I_2 + I_2 + K_2SO_4$
$KI + I_2 \rightarrow KI_3$
$Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + NaI$
all other options are correct

21. Which of the following contains maximum number of atoms-
(1) 6.023×10^{21} molecules of CO_2 (2) 22.4L of CO_2 at STP
(3) 0.44 gm of CO_2 (4) None of these

Ans. (2)

Sol. Option 1 cantains $3 \times 6.022 \times 10^{21}$
Option 2 cantains $3 \times 6.022 \times 10^{23}$
Option 3 cantains $3 \times 6.022 \times 10^{21}$
so option 2 is correct

22. Elimination of hydrogen bromide from 2-bromobutane results in the formation of-
(1) Predominantly 1-butene (2) Predominantly 2-butyne
(3) Equimolar mixture of 1-butene and 2-butene (4) Predominantly 2-butene

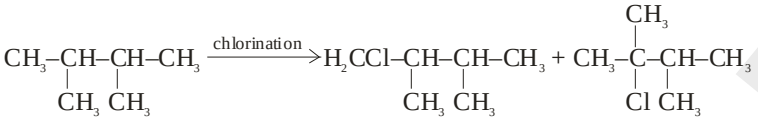
Ans. (4)

Sol. auording to saytzeff's rule, which states that when two alkenes may be formed, the alkene which is most substituted one predominates and therefore option 4 that is 2-butene predominates.

23. Of the isomeric hexanes, the isomer which can give two monochlorinated compounds is -
(1) 2, 2-dimethyl butane (2) 2-methyl pentane
(3) n-hexane (4) 2, 3-dimethyl butane

Ans. (4)

Sol. 2, 3-dimethyl butane contains only two types of H-atoms. Hence, only 2 mono chlorinated compounds are formed.



24. Which of the following pair of compounds cannot exist together in a solution ?
(1) Na_2CO_3 and $NaHCO_3$ (2) Na_2CO_3 and NaOH
(3) $NaHCO_3$ and NaOH (4) $NaHCO_3$ and NaCl

Ans. (3)

Sol. They both undergo chemical reation and therefore cannot exist together in solution $NaHCO_3$ is an acidic salt while NaOH is a base.
Chemical reaction $NaHCO_3 + NaOH \rightarrow Na_2CO_3 + H_2O$.

25. If 0.50 moles of $BaCl_2$ is mixed with 0.20 moles of Na_3PO_4, the maximum number of moles of Ba_3PO_4, the maximum number of moles of $Ba(PO_4)_2$ formed will be -
(1) 0.70 (2) 0.50 (3) 0.20 (4) 0.10

Ans. (4)

Sol. Balanced chemical equation:
$3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaCl$
3 moles of $BaCl_2$ react with 2 moles of Na_3PO_4 to give 1 mole of $Ba_3(PO_4)_2$

0.5 moles of $BaCl_2$ will react with $\frac{2}{3} \times 0.5$ = 0.33 moles of Na_3PO_4. Available moles of Na_3PO_4 = 0.2 (L.R.)

Now, 2 moles of Na_3PO_4 give 1 mole of $Ba_3(PO_4)_2$

So, 0.2 moles of Na_3PO_4 with give $\frac{2}{3} \times 0.2$ = 0.1 mole of $Ba_3(PO_4)_2$

26. During electrolytic production of aluminium, the carbon anodes are replaced from time to time because -
(1) The carbon anodes get decayed
(2) The carbon prevents atmospheric oxygen in contact with aluminium
(3) Oxygen liberated at the carbon anode reacts with anode to form CO_2
(4) Carbon converts Al_2O_3 to Al

Ans. (3)

Sol. This is because the carbon anodes are being consumed during the electrolysis process forming CO_2. Thus, as the reaction proceeds, the anode needs to be lowered as it is consumed and at some point, it will be replaced to ensure that the current collectors are not in contact with the electrolyte.

27. A plant cell, an animal cell and bacterial cell share the following structure features -
(1) Cell membrane, Endoplasmic reticulum and Vacuole
(2) Cell wall, Plasma membrane, Mitochondria
(3) Cell wall, Nucleus and Cytoplasm
(4) Plasma membrane, Cytoplasm, Ribosome

Ans. (4)

Sol. Prokaryotic cells lack membrane-bound organelles.

28. The average temperature of earth is fairly stable as compared to the moon. this is because of -
(1) Biosphere (2) Lithosphere (3) Atmosphere (4) None of the above

Ans. (3)

Sol. Atmosphere is a blanket of gases that keeps temperature of earth stable.

29. Which of the following statement is true about the "Law of Segregation".
(1) Law of Segregation is the law of purity of genes
(2) Alleles separates form each other during gamete to genesis
(3) Segregation of factors is due to segregation of chromosomes during Meiosis
(4) All of the above

Ans. (4)

Sol. All of the above statements explain law of segregation.

30. Most fishes do not sink in water due to the presence of
(I) Swim bladder
(II) Air bladder
(III) Air sacs
(IV) Air in spongy bones
(1) I & II are correct (2) II & III are correct (3) III & IV are correct (4) I, II & III are correct

Ans. (1)

Sol. Swim bladders and air bladders help fishes to control their buoyancy.

31. In most mammals testis are situated outside of the abdominal cavity, because -
(1) More number of sperms are produced in scrotal sac
(2) Longivity of sperm is enhanced
(3) Sperm in scrotal sac requires lesser temperature for efficient fertilization
(4) Sperm in scrotal sac and bigger

Ans. (3)

Sol. Spermatogenesis requires temperature 2-3°C lesser than body temperature.

32. The gene for the genetic disease "Haemophilia" is present on the 'X' chromosome. If a haemophilic male marries a normal female, what would be the probability of their son being haemophilic.
(1) 50% (2) 100% (3) Nil (4) 3 : 1

Ans. (3)

Sol. None of their son will be haemophilic. Haemophilia is an X-linked recessive disease.
Haemophilic male X Normal female
X^hY X XX

$$\underset{\text{carrier}}{\underline{X^hX \;\; X^hX}} \quad \underset{\text{normal}}{\underline{XY \;\; XY}}$$

[as gene is present on X-chromosome all male (sons) are normal and females are carrier]

33. Populations are said to be sympatric when -
(1) Two populations are physically isolated by a natural barrier
(2) They live together and freely interbreed to produce sterile offsprings
(3) Two populations share the same area/environment but do not interbreed
(4) Two populations are isolated, but occasionally come together to interbreed

Ans. (3)

Sol. Sympatric speciation in the evolution of a new species from a surviving ancestral species while both continue to inhabit the same geographic region.

34. Pollen grain of a plant (2n = 28) are cultured to produce callus tissues by tissue culture methods. What would be the chromosome number in the cells of callus.
(1) 28 (2) 21 (3) 14 (4) 56

Ans. (3)

Sol. Pollen grain is haploid i.e. (n)
where 2n 28 ; then n = 14
Thus tissue culure will result in all haploid cells = n = 14

35. Cell vary in their size. Arrange the following cells in an ascending order of their size and select the correct option among the following.
(I) Mycoplasma
(II) Ostrich egg
(III) Human RBC
(IV) Bacteria
(1) I, IV, III, II (2) I, II, III, IV (3) II, I, III, IV (4) III, I, II, IV

Ans. (1)

Sol. According to size
smallest is - Mycoplasma
- Bacteria
- RBC (Human)
- Ostrich egg

36. Many elements are found in living organisms either free of in the form of compounds. One of the following is not found in living organism.
(1) Magnesium (2) Iron (3) Sodium (4) Silicon

Ans. (4)
Silicon is not found in living organisms.

37. During photosynthesis one CO_2 molecule is fixed through Calvin Cycle. This process requires -
(1) One ATP and Two $NADPH_2$ (2) Two ATP and Two $NADPH_2$
(3) Three ATP and Two $NADPH_2$ (4) Two ADP and One $NADPH_2$

Ans. (3)

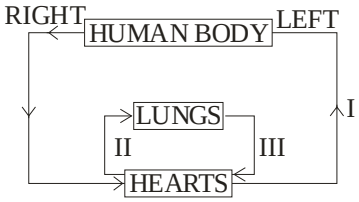
Sol. According to calvin cycle energetics, It uses 18 ATP and 12 NADP H_2 molecule to produce 1 glucose molecule.

38. A piece of DNA contains a total of 1200 nucleotides out of which 200 are adenine bases. How many cytosine bases are present in this segment of DNA.
(1) 200 (2) 400 (3) 600 (4) 100

Ans. (2)

Sol. According to Chargaff's rule, A + G = C + T.

39. Figure below reflects the blood circulation system in the human body.



Which of the path contains oxygenated blood.

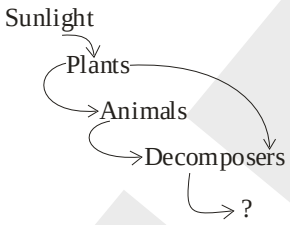
(1) 1 & II only (2) II & III only (3) I & III only (4) I, II & III all

Ans. (3)

Sol. Oxygenated blood flows from

- heart to body (through aorta)
- lungs to heart (through p.vein)

40. The following diagram shown a simple version of energy flow through food web.



What happens to energy having the decomposers ?

(1) It is used by the decomposers itself

(2) It is reflected form the surface of earth

(3) It is lost as heat

(4) It is used in natural Biocomposting

Ans. (4)

Sol. Decomposers break dead & decaying matter on releasing nutrients into soil, which are then recycled.

41. The unit digit in the expression $55^{725} + 73^{5810} + 22^{853}$ is -

(1) 0 (2) 4 (3) 5 (4) 6

Ans. (4)

Sol. $55^{725} + 73^{5810} + 22^{853}$

$\downarrow \quad \downarrow \quad \downarrow$

$5 + 3^2 + 2^1$

$5 + 9 + 12 = 16$

unit digit = 6

42. The value of $\frac{3}{4}+\frac{5}{36}+\frac{7}{144}+...+\frac{17}{5184}+\frac{19}{8100}$ is

(1) 0.95 (2) 0.98 (3) 0.99 (4) 1

Ans. (3)

Sol. $1-\frac{1}{4}+\frac{1}{4}-\frac{1}{9}+\frac{1}{9}-\frac{1}{16}+.....+\frac{1}{81}-\frac{1}{100}$

$= 1 - \frac{1}{100} = 0.99$

43. For real y, the number of solutions of the equation $\sqrt{y+3}+\sqrt{y} = 1$ is ....

(1) 0 (2) 1 (3) 2 (4) 4

Ans. (1)

Sol. $\sqrt{y+3} + \sqrt{y} = 1$

$\therefore \quad \sqrt{y+3} = 1-\sqrt{y}$ Put y = 1

$y+3=1+y-2\sqrt{y}$ LHS $\neq$ RHS

$-1 = \sqrt{y}$

no. of solution = 0

44. The polynomial, $f(x) = (x-1)^2 + (x-2)^2 + (x-3)^2 + (x-4)^2$ has minimum value, when x = ...

(1) 40 (2) 20 (3) 10 (4) 2.5

Ans. (4)

Sol. $f(x) = (x-1)^2 + (x-2)^2 + (x-3)^2 + (x-4)^2$ .....

$f(x) = 2(x-1) + 2(x-2) + 2(x-3) + 2(x-4) = 0$

$x = 2.5$

45. If the roots of the equation $x^2 + 2px + q = 0$ and $x^2 + 2qx + p = 0$ differ by a constant and $p \neq q$, then the value of p + q is

(1) –1 (2) 1 (3) 2 (4) None of these

Ans. (1)

Sol. $x^2 + 2px + q = 0$

$\Rightarrow$ roots are α and β

$\alpha + \beta = -2p$

$\alpha\beta = q$

$\Rightarrow$ roots are $\alpha + c$ and $\beta + c$

$\alpha + \beta + 2c = -2q$

$\Rightarrow$ from equations

$c = p - q$

$x^2 + 2px + p = 0$

$(\alpha + c)(\beta + c) = p$

$c(c - 2p) = p - q$

$(p - q)(p - q - 2p) = p - q$

$-(p + q) = 1$

$p + q = -1$

46. If $\sin\theta + \sin^2\theta = 1$, then $\cos^{12}\theta + 3\cos^{10}\theta + 3\cos^8\theta + \cos^6\theta$ = ...

(1) $\sin\theta$ (2) $\cos\theta$ (3) 0 (4) 1

Ans. (4)

Sol. $\sin\theta + \sin^2\theta = 1$

$\sin\theta = \cos^2\theta$

$\Rightarrow$ $= \cos^{12}\theta + 3\cos^8\theta + 3\cos^{10}\theta + \cos^6\theta$

$= \cos^6\theta [\cos^6\theta + 3\cos^4\theta + 3\cos^2\theta + 1]$

$= \sin^3\theta [\sin^3\theta + 3\sin^2\theta + 3\sin\theta + 1]$

$= \sin^3\theta (\sin\theta + 1)^3$

$= \sin^3\theta (\sin\theta + 1)^3$

$= (\sin^2\theta + \sin\theta)^3$

$= 1^3 = 1$

47. From a bag containing 100 tickets numbered 1, 2, 3, ..., 100 one ticket is drawn. If the number on this ticket is x, then the probability that $x + \frac{1}{x} > 2$ is.

(1) 0 (2) 0.99 (3) 1 (4) None of these

Ans. (2)

Sol. A.M $\geq$ G.M

$$\frac{x + \frac{1}{x}}{2} \geq \left(x \times \frac{1}{x}\right)^{1/2}$$

$$x + \frac{1}{x} \geq 2$$

So for x = 1

$$\frac{x+1}{x} = 2$$

for $1 < x \leq 100$

$$\frac{x+1}{x} > 2$$

so 99 possibilities

$$p = \frac{99}{100} = 0.99$$

48. For which value of K the system of equations $3x + y = 1$ and $(2k-1)x + (k-1)y = (2k+1)$ has no solution

(1) –2 (2) +2 (3) –3 (4) +3

Ans. (2)

Sol. $\frac{a_1}{b_1} = \frac{a_2}{b_2}$

$$\frac{3}{2k-1} = \frac{1}{k-1}$$

$3k - 3 = 2k - 1$

$\therefore$ $k = 2$

49. If the vertices of a triangle are (1, 2), (4, – 6) and (3, 5) then
(1) Triangle is right angled
(2) The area of triangle is 12.5 sq. units
(3) The points do not from a triangle
(4) None of these

Ans. (2)

Sol. A(1, 2), B(4, –6), C(3, 5)

$$A = \frac{1}{2}\left|\begin{bmatrix} 1 & 4 & 3 & 1 \\ 2 & -6 & 5 & 2 \end{bmatrix}\right|$$

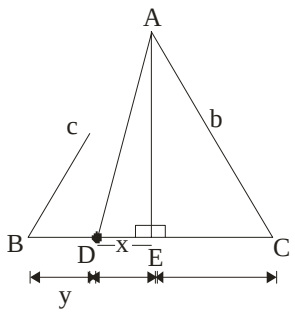
A = 12.5 sq.unit

50. In a ΔABC, D is the mid-point of BC and E is the foot of the perpendicular drawn form A on BC. If ED = x, AD = p, AE = h and BC = a, then $2b^2 + 2c^2 - a^2$ = ...

(1) p^2 (2) $2p^2$ (3) $4p^2$ (4) None of these

Ans. (3)

Sol.



Let BC = 2y = a

DE = x

$2b^2 + 2c^2 - a^2$

$= 2[h^2 + (y - x)^2] + 2[h^2 + (y + x)^2] - (2y)^2$

$= 4h^2 + 4y^2 + 4x^2 - 4y^2$

$= 4(h^2 + x^2)$

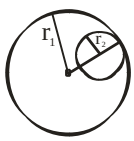
$= 4p^2$

51. Two circles of radii r_1 cm and r_2 cm ($r_1 > r_2$) touches each other internally. The sum of their areas is πA^2 cm^2 and the distance between their centres is d cm, then -

(1) A > d (2) A < d (3) $A\sqrt{2}$ > d (4) A > $\sqrt{2}$d

Ans. (1)

Sol.



sum of area of two circle

$\pi r_1^2 + \pi r_2^2 = \pi A^2$

$r_1^2 + r_2^2 = A^2$

and $r_1 - r_2 = d$

squaring both side

$r_1^2 + r_2^2 - 2r_1r_2 = d^2$

$A^2 = d^2 + 2r_1r_2$

so that

$A^2 > d^2$

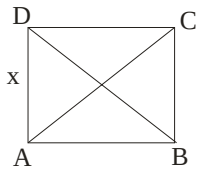
$A > d$

52. ABCD is a rectangle such that AC + AB = 5 AD and AC – AD = 8, then the area of rectangle ABCD is

(1) 36 sq. units (2) 50 sq. units (3) 60 sq. units (4) Cannot be found

Ans. (3)

Sol.



let AD = x

AC = x + 8

In ΔABD by pythagoras then

$AB^2 = BD^2 - AD^2$

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

$AB^2 = 16(x + 4)$

$AB = 4\sqrt{x+4}$

AB + AC = 5AD

$4\sqrt{x+4} + x + 8 = 5(x)$

$4\sqrt{x+4} = 4x - 8$

$\sqrt{x+4} = x - 2$

squaring both side

$x + 4 = x^2 - 4x + 4$

$x^2 - 5x = 0$

$x = 5$ or $(x \neq 0)$

$AB = 4\sqrt{5+4} = 4 \times 3 = 12$

AD = 5

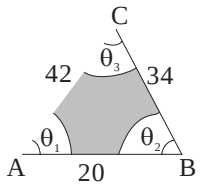
are AB × AD = 12 × 5 = 60

53. A triangular field, having grass, has sides 20m, 34m and 42m respectively. Three horses are tied to each of the vertices with a rope of length 7m, each . The horses start grazing the field. The area of the portion of the field that is ungrazed by the horses is .....m^2

(1) 250 (2) 255 (3) 258 (4) 259

Ans. (4)

Sol.



$s = \frac{20+34+42}{2} = \frac{96}{2} = 48$

$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{48(48-20)(48-34)(48-42)}$

$= \sqrt{48\times28\times14\times6} = 14 \times 6 \times 4$

$= 336\ m^2$

area of sector $= \frac{\theta}{360}\pi r^2$

area of shaded = area of Δ – area of 3 sector
area of ΔABC by heron's formula

area of shaded $= 336 - \left(\frac{\theta_1+\theta_2+\theta_3}{360}\right) \times \pi r^2$

$= 336 - \frac{180}{360}\pi \times 7^2$

$\Rightarrow \quad 336 - \frac{1}{2}\times\frac{22}{7}\times7\times7$

$= 336 - 77$

$\Rightarrow \quad 259\ m^2$

54. A cube of side 12 cm, is painted blue of all the faces and then cut into smaller cubes each of side 3 cm. The total number of smaller cubes having none of their faces painted blue will be.

(1) 8 (2) 12 (3) 16 (4) 24

Ans. (1)

Sol. Total no of cube of 3 cm side = 64
(n = 4)
no of cube having none of their a face painted = $(n-2)^3$
= 8 cube

55. The ratio of the roots of the equation $ax^2 + bx + c = 0$ is same as the ratio of the roots of the equation $px^2 + qx + r = 0$. If D_1 and D_2 are the discriminants of $ax^2 + bx + c = 0$ and $px^2 + qx + r = 0$ respectively then $D_1 : D_2$ =

(1) $\frac{a^2}{p^2}$ (2) $\frac{b^2}{q^2}$ (3) $\frac{c^2}{r^2}$ (4) None of these

Ans. (2)

Sol. Let α, β are root of $ax^2 + bx + c = 0$

and γ,δ are root of $px^2 + qx + r = 0$

difference of root = $\alpha - \beta = \sqrt{(\alpha+\beta)^2 - 4\alpha\beta}$

$$\alpha - \beta = \frac{\sqrt{D}}{a}$$

$$\frac{\alpha}{\beta} = \frac{\gamma}{\delta}$$

by componendo & dividendo

$$\frac{\alpha-\beta}{\alpha+\beta} = \frac{\gamma-\delta}{\gamma+\delta}$$

$$\frac{\frac{\sqrt{D_1}}{a}}{\frac{-b}{a}} = \frac{\frac{\sqrt{D_2}}{p}}{\frac{-q}{p}}$$

$$\sqrt{\frac{D_1}{D_2}} = \frac{b}{q} \Rightarrow \frac{D_1}{D_2} = \frac{b^2}{q^2}$$

56. A conical shaped container, whose radius of base is r cm and height is h cm, is full of water. A sphere of radius R is completely immersed in the container in such a way that the surface of sphere touches the base of the cone and its surfaces. The portion of water which comes out of the cone is .....

(1) $\frac{R^2}{r^2h}$ (2) $\frac{r^2}{R^2h}$ (3) $\frac{4R^2}{r^2h}$ (4) $\frac{4r^2}{R^2h}$

Ans. (NA)

Sol. Volume of sphere = $\frac{4}{3}\pi R^3$

volume of cone = $\frac{1}{3}\pi r^2 h$

portion of water which come out from the cone = $\frac{\text{volume of sphere}}{\text{volume of cone}}$

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

57. The arithmetic mean of 10 observations is 12.45. If each reading is increased by 5 then the resulting mean is increased by

(1) 5 (2) 29 (3) 0.5 (4) 50

Ans. (1)

Sol. Arithmetic mean

It a every observation increase by a fixed number, the mean also increase by that number

58. 20 women can do a job in 20 days. After each day one woman is replaced by aman or a boy alternatively, starting with a man. A man is twice efficient and a boy is half efficient as a woman. The job gets completed on .... day.

(1) 16th (2) 18th (3) 20th (4) 24th

Ans. (2)

Sol. day 1 total work = $\frac{1}{400}=\frac{40}{800}$

day 2 total work = $\frac{19}{400}+\frac{1}{200}=\frac{42}{800}$

day 3 total work = $\frac{18}{400}+\frac{1}{200}+\frac{1}{800}=\frac{41}{800}$

day 4 total work = $\frac{43}{800}$

so numerator follow this form

40, 42, 41, 43, 42, 44, ...

so we have 2 AP

40, 41, 42, ... and 42, 43, ...= 4 n term

sum AP_1 + sum AP_2 = 800

so that no. of term should be = 18

59. In ΔABC, $\angle A = 90°$ and points D and E divide BC into three equal parts. If $3AC^2 + 5AB^2 = p\,AE^2$ then p = ...

(1) 2 (2) 4 (3) 6 (4) 8

Ans. (NA)

60. The mode of observations 7, 12, 8, 5, 6, 4, 9, 10, 8, 9, 7, 9, 6, 5, 9 is

(1) 7 (2) 8 (3) 9 (4) 12

Ans. (3)

Sol.

Obsorvation	Freq.
7	2
12	1
8	2
5	2
6	2
4	1
9	4
10	1

Mode = 9

61. Mazzini, the founder of young Italy, conducted the slogan
(I) God (II) The revolutionaries
(III) People (IV) Italy
(1) I, II and III (2) I, II and IV (3) I, III and IV (4) II, III and IV
Ans. (3)
Sol. Mazzini founded young Italy. He believed that god has intended nations to be the natural of mankind.
62. The credit for Unification of Italy goes to -
(I) Cavour (II) Mazzini (III) Markham (IV) Garibaldi
(1) I, II and IV (2) I, II and III (3) I, III and IV (4) II, III and IV
Ans. (1)
Sol. Markhan is the name of Italian ethnic.
63. Which of the following statements relating to Russian Revolution are correct ?
(I) The rule of Czar Nicholas II was oppressive (II) Czar was under the influence of his minister Plehve
(III) The minorities sided with the Czar (IV) Russian Revolution occurred only in March 1917
(1) I and III (2) I and IV (3) I and II (4) II and III
Ans. (1)
Sol. Plehve was the Russion minister of interior Russia revolution was occurted in 1905 & 1917.
64. Lening finally stressed upon -
(I) Nationalisation of industries (II) Collective farms
(III) Controlled Capitalism (IV) War Communism
(1) I, II and IV (2) II, III and IV (3) III and IV (4) II and III
Ans. (3)
Sol. Lening gave stressed upon controlled capitalism & war communism.
65. Which one of these constitute Indo China ?
(I) Vietnam (II) Philippines (III) Laos (IV) Combodia
(1) I, II and III (2) I, III and IV (3) II, III and IV (4) III and IV
Ans. (2)
Sol. Philipines was not in Indo-china.
66. Triple Entente, 1907 comprised of -
(I) Britain (II) Russia (III) Italy (IV) France
(1) I, II and IV (2) I, III and IV (3) I, II and III (4) II, III and IV
Ans. (1)
Sol. Italy was on the side of Triple Alliance.
67. Triple Alliance, 1882 comprised of -
(I) Germany (II) Austria (III) Italy (IV) Turkey
(1) I, II and III (2) I, III and IV (3) II, III and IV (4) I, II and IV
Ans. (1)
Sol. Ottoman turkey joined alliance but it was joined in 1915.
68. Hind Swaraj was written by which by which writer?
(1) Vallabh Bhai Patel (2) M.K. Gandhi (3) Raja Gopalachari (4) Tej Bahadur Sapru
Ans. (2)
Sol. Mahatma Gandhi wrote Hind Swaraj in 1909.
69. Mahatma Gandhi determined to stop which movement after chauri chaura incident?
(1) Champaran Satyagrah (2) Khilafat movement
(3) Non Co-operation Movement (4) Civil Disobedience Movement
Ans. (3)
Sol. After the violent protest at chauri chaura in 1921 Gandhiji stopped NCM.

70. Lahore Conference of Indian National Congress in 1929 declared independence under the Presidentship of which Leader?
(1) Moti Lal Nehru (2) Jawahar Lal Nehru
(3) Subhash Chandra Bose (4) Lala Lajpat Rai
Ans. (2)
Sol. Lohore congrees of Indian National conference was held under Presidentship of Jawahar lal Nehru.
71. Henry Patullo, an officer of East India Company was of the view -
(1) Indians do not repare cloth (2) Indians should be banned to prepare cloth
(3) Indian cloth is the best in the world (4) Indian cloth is not better than that of England
Ans. (3)
Sol. Henry Patullo was an English citizen who came to India & predicted that the demand for Indian textiles could never reduce because of its fine quality.
72. Printing Press was introduced to India for the first time in the 16th Century by which missionary -
(1) French (2) Dutch (3) British (4) Portuguese
Ans. (4)
Sol. The printing press first came to Goa with portueguese missionaries.
73. Identify the crop which is cultivated in the tropical highlands of India and grows well particularly on the laterite soils of Karanataka and Tamilnadu.
(1) Groundnut (2) Cotton (3) Coffee (4) None ofthese
Ans. (3)
Sol. Coffee grows well in highland of Karanataka and Tamilandu.
74. Agricultural forestry is mainly practised in which state of India?
(1) Jharkhand (2) Haryana (3) Rajasthan (4) Uttrakhand
Ans. (2)
Sol. Agroforestry is a land use management system in which trees are grown around pastureland of Haryana.
75. Which of the following is the most recent mountain ranges?
(1) Eastern Ghat (2) Western Ghat (3) Satpura Series (4) Shillong Series
Ans. (4)
Sol. Shillong series is the youngest or recent mountain ranges.
76. Shimoga mines is famous for :
(1) Iron ore (2) Gold (3) Manganese (4) Petroleum
Ans. (2)
Sol. Deccan gold mines, the country's only listed gold exploration company located at shimoga
77. The headquater of newly formed Sourthern Coastal Railway Zone of India is located at :
(1) Vishakhapatnam (2) Kakinada (3) Hyderabad (4) Masulipatanam
Ans. (1)
Sol. The newly formed southern coastal railway zone at Vishakhapatnam announced in 2019.
78. Arrange the given mountain ranges from North to Sourth in direction.
(I) Karakoram (II) Ladakh (III) Zaskar (IV) Pir Pinjal
(1) I, II, III, IV (2) II, I, IV, III (3) II, III, I, IV (4) IV, III, II, I
Ans. (1)
Sol. Karakoram continues into Pakistan and Chian to the southern zaskar range, then ladakh & to south lies pir panjal ranges.
79. Which of the following pairs is not correctly matched?
(I) Himalaya mountain – Tertiary Fold Mountain
(II) Deccan Trap – Volcanic Eruption
(III) Western Ghats – Paleozoic Fold Mountain
(IV) Aravali Mountain – Pre-Cambrian Relict Mountain
(1) Only I (2) I & II (3) Only III (4) Only IV

Ans. (3)

Sol. Western ghate are also known as sahyadri meaning, The Benovalent mountains.

80. A person wants to visit the national parks of Kanha, Kaziranga and Dudhwa located in different states of India. In which of the following states he is not required to move in this connection.

(1) Madhya Pradesh (2) Uttrakhand (3) Assam (4) Uttar Pradesh

Ans. (2)

Sol. Uttarakhand where Jim Corbett national Park Situated.

81. Which of the following is the correct descending order of soils of India according to their coveragearea?

(1) Alluvial, Red, Laterite, Black (2) Black, Alluvial, Red, Laterite

(3) Alluvial, Black, Red, Laterite (4) Alluvial, Laterite, Black, Red

Ans. (1)

Sol. Alluvial - 45.6, Blank - 16.6, Red - 16.6 Laterite - 6.4%

82. Match List-I (Tribes) with List-II (States) and select the correct answer using the codes given below.

List-I (Tribes)	List-II (State)
A. Bodo	I. Nagaland
B. Naga	II. Andaman Islands
C. Jarawa	III. Assam
D. Mina	IV. Rajasthan

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

Ans. (3)

Sol. Bodo Tribe in Assam, Naga in Nagaland, Jarwa in Andaman & Nicober and & Mina in Rajastan.

83. Which of the following rivers meet Ganga from South direction in Bihar ?

A. Kosi B. Son C. Gandak D. Ghaghra

(1) A and B (2) B and C (3) Only D (4) Only B

Ans. (4)

Sol. Son is only the river which flow in south of Bihar join Ganga.

84. Match List-I (Hydroelectric Plant) with List-II (River) and select the correct answer using the codes given below.

List-I (Hydroelectric Plant)	List-II (River)
A. Bhakhra	I. Beas
B. Pong	II. Periyar
C. Salal	III. Satluj
D. Idukki	IV. Chenab

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

Ans. (3)

Sol. Bhakra over Satluj river, Pong over Beas river salal over chenab & Idduki over periyar river.

85. Which one of the following is correct regarding power sharing?

(1) It leads to conflict among different social groups.

(2) It ensures the stability of the country.

(3) It undermines the unity of the nation.

(4) It creates hurdle in decision making process.

Ans. (3)

Sol. It ensures the stability of the country.

86. Which one of the following is the best example of coming together federation?

(1) The U.S.A. (2) India (3) Spain (4) Belgium

Ans. (1)

Sol. The U.S.A.

87. Which of the following countries has community governmnet?
(1) Spain (2) Sri Lanka (3) Belgium (4) France
Ans. (3)
Sol. Belgium Here all the ethnic community formed the community govt.
88. Which among the following is not the basis of social divisions in India?
(1) Language (2) Health (3) Region (4) Caste
Ans. (2)
Sol. Language, caste and religion are the basis of social divisions.
89. The administrative head of Municipal Corporation is called :
(1) Mayor (2) Deputy-Mayor
(3) Municipal Comminssioner (4) Sarpanch
Ans. (3)
Sol. Political head of Muncipal Corporation is Mayor but Administrative Head is Municipal Commissioner.
90. In democracy, power is finally concentrated in the hands of -
(1) Bureaucrats (2) Parliament (3) Electorate (4) Council of Ministers
Ans. (3)
Sol. In democracy power is finally concentrated in t he hands of electorate or (Voter).
91. Which of the following is considered life -line of democracy ?
(1) Government (2) Constitution (3) Political Parties (4) Judiciary
Ans. (3)
Sol. Political parities are considered as life line of democracy.
92. In which country, the political parties came into existence first ?
(1) Britain (2) India (3) France (4) The U.S.A
Ans. (1)
Sol. After glorious revolution political parties came into existence in Britain.
93. Which of the following statements are not true?
I. Empolyment in the service sector has not increased to the same extent as production.
II. Workers in the tertiary sector produce goods.
III. The activities in Primary, Secondary and Tertiary sectors are not interdependent.
IV. A large proportion of labourers in India are working in Unorganised Sector
(1) I and III (2) III, IV and V (3) I, II and V (4) II, III and IV
Ans. (4)
Sol. Workers of tertiary sector give services. Primary, secondary & teritary sectors are interdependent & workers in unorgenised sector do not enjoy job security.
94. Which one of the following is not a function of the central bank in an economy ?
(1) Dealing with foreign exchange (2) Controlling monetary policy
(3) Controlling government spending (4) Acting as a banker's bank
Ans. (3)
Sol. Govt. spending is controlled by Parliament
95. If saving exceed investement then -
(1) National income rises (2) National income falls
(3) National income is not affected (4) None of the above
Ans. (3)
Sol. Saving is more then investment which will not affect present national income.
96. Which indicators are used in the Human Development Index (HDI)?
I. Standard of living II. Eduction
III. Life expectancy rate IV. Condition of environment
(1) Only I, II and IV (2) Only I, II and III (3) Only I and II (4) All of the above
Ans. (2)
Sol. Condition of environment is not the indicator of human development index.

97. Which of the following statements are not true ?
I. COPRA applies only to goods.
II. India is one of the many countries in the word which has exclusive courts for consumer redressal.
III. When a consumer feels that he has been exploited, he must file a case in the District Consumer Court.
IV. It is worthwhile to move to consumer courts only if the damages incurred are of high value.
V. Hallmark is the certification maintained for standardisation of jewellary.
VI. The consumer redressal process is very simple and quick.
VII. A consumer has the right to get compensation depending on the degree of the damage.
(1) Only II, III, IV, V and VII (2) Only I and VI
(3) Only I, II, V and VII (4) All of the above

Ans. (1)

Sol. COPRA – Consumer Protection Act applies to goods & services.

98. Which of the following statements are true about globalisation ?
I. Developed countries have always been more benefitted from globalisation.
II. Globalisation has led to improvement in living condition of workers in the developing countires.
III. Globalisation is the process of rapid integration or interconnection between countries.
IV. Indian cement industries have been hit hard by globalisation.
V. To achieve the goal of fair globalisation, major roles can be played by MNCs.
(1) Only I, II, III and V (2) Only I, II, III and IV (3) Only III, IV and V (4) Only I, II and III

Ans. (4)

Sol. Indian cement industry boosted due to globalisation.

99. In a SHG (self help group) most of the decisions regarding saving and loan activites are taken by -
(1) Bank (2) Members (3) State Government (4) Chairperson of SHG

Ans. (2)

Sol. In SHG decisions reqarding saving and loan activities are taken by its member only.

100. We can obtain per capita income of a coutry by calculating -
(1) Total income of a person.
(2) By dividing the national income by the total population of a country.
(3) The total value of all goods and services.
(4) Total exports of the country.

Ans. (2)

Sol. National Income and Total Population.