NATIONAL TALENT SEARCH EXAMINATION (NTSE-2017) STAGE -1
WEST BENGAL STATE : SAT

Date: 13/11/2016

Max. Marks: 100 **SOLUTIONS** **Time allowed: 90 mins**

1. If $a + b + c = 1$ and $ab + bc + ca = \frac{1}{3}$, Then a : b : c is

(a) 1 : 2 : 1 (b) 1 : 1 : 2 (c) 2 : 1 : 1 (d) 1 : 1 : 1

Ans. ***(d)***

Sol. $a + b + c = 1$, $ab + bc + ca = \frac{1}{3}$

$(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$

$1 = a^2 + b^2 + c^2 + \frac{2}{3}$

$a^2 + b^2 + c^2 = \frac{1}{3}$

$\therefore \quad a^2 + b^2 + c^2 = ab + bc + ca$

$a^2 + b^2 + c^2 - ab - bc - ca = 0$

$(a - b)^2 + (b - c)^2 + c(c - a)^2 = 0$

$a = b = c = \frac{1}{3}$

$a : b : c = \frac{1}{3} : \frac{1}{3} : \frac{1}{3} = 1 : 1 : 1$

2. The integral value of k for which the equation $(k - 12)\,x^2 + 2\,(k - 12)\,x + 2 = 0$ possesses no real solutions is

(a) 12 (b) 13 (c) 14 (d) All of the above

Ans. ***(b)***

Sol. $(k - 12)\,x^2 + 2(k - 12)\,x + 2 = 0$

for no real solution

$D < 0$

$b^2 - 4ac < 0$

$[2(k - 12)]^2 - 4(k - 12) \cdot 2 < 0$

$2(k - 12)\,[2(k - 12) - 4] < 0$

$(k - 12)\,[2k - 24 - 4] < 0$

$(k - 12)\,(2k - 28) < 0$

$12 < k < 14$

$\Rightarrow \; k = 13$

3. The value of $\sqrt{\sqrt{28 - 16\sqrt{3}}}$ is

(a) $\sqrt{3} - 1$ (b) $1 - \sqrt{3}$ (c) $2\sqrt{3} - 4$ (d) $4 - 2\sqrt{3}$

Ans. ***(a)***

Sol. $\sqrt{\sqrt{28 - 16\sqrt{3}}}$

$= \sqrt{\sqrt{(4)^2 + (2\sqrt{3})^2 - 2 \times 2\sqrt{3} \times 4}}$

$= \sqrt{\sqrt{(4 - 2\sqrt{3})^2}} = \sqrt{4 - 2\sqrt{3}}$

$= \sqrt{(\sqrt{3})^2 + (1)^2 - 2 \times \sqrt{3} \times 1}$

$= \sqrt{(\sqrt{3} - 1)^2} = \sqrt{3} - 1$

4. If $\sqrt{\left(x^2 - x - 6\right)^2} = (x + 2)(3 - x)$, then value(s) of x

(a) does not exist (b) $-2 \le x \le 3$ (c) $x = -2, 3$ (d) $x = 0$

Ans. ***(b)***

Sol. Here, $(x + 2)(3 - x) \ge 0$ as $\sqrt{y} \ge 0$ for $y \ge 0$

$\Rightarrow (x - 3)(x + 2) \le 0$

$\Rightarrow -2 \le x \le 3$

5. If a and b are the non-zero distinct roots of $x^2 + ax + b = 0$, the least value of $x^2 + ax + b$ is

(a) $\frac{4}{9}$ (b) $-\frac{4}{9}$ (c) $\frac{9}{4}$ (d) $-\frac{9}{4}$

Ans. ***(d)***

Sol. $x^2 + ax + b = 0$

$a + b = -a$

$2a + b = 0$

$ab = b$

$a = 1$

$b = -2$

$x^2 + x - 2$

$$= \left(x + \frac{1}{2}\right)^2 - \frac{1}{4} - 2$$

$$= \left(x + \frac{1}{2}\right)^2 - \frac{9}{4}$$

Thus, least value $= -\frac{9}{4}$

6. The number of solution of the equation $\sqrt{x^2} = x - 2$ is

(a) 1 (b) 2 (c) 0 (d) 4

Ans. ***(c)***

Sol. $\sqrt{x^2} = x - 2$ ...(1)

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

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

$4x = 4$

$x = 1$

Substituting in eq^n

$\sqrt{x^2} = x - 2$

$1 = 1 - 2$

$1 = -1$

$x = 1$ does not satisfy eq^n (1)

Hence, no solutions.

7. A circle having centre at origin passes through the point $\left(\frac{13}{2}, 0\right)$. Which of the following points does not lie inside the circle ?

(a) $\left(-\frac{3}{4}, 1\right)$ (b) $\left(2, \frac{7}{3}\right)$ (c) $\left(5, \frac{1}{2}\right)$ (d) $\left(-6, \frac{5}{2}\right)$

Ans. ***(d)***

Sol. Radius of circle $= \sqrt{\left(0 - \frac{13}{2}\right)^2 + (0-0)^2}$

$= \frac{13}{2} = 6.5$

distance of (0, 0) & $\left(-\frac{3}{4}, 1\right)$ is

$\sqrt{\left(0 + \frac{3}{4}\right)^2 + (0-1)^2} = \sqrt{\frac{9}{16} + 1} = \frac{5}{4} = 1.25$

distance of (0, 0) & $\left(2, \frac{7}{3}\right)$ is $\sqrt{2^2 + \left(\frac{7}{3}\right)^2}$

$= \sqrt{4 + \frac{49}{9}} = \sqrt{\frac{49+36}{9}}$

$= \sqrt{\frac{85}{9}} = \sqrt{\frac{85}{3}} = 3.07$

distance of (0, 0) & $\left(5, \frac{1}{2}\right)$ is $\sqrt{5^2 + \left(\frac{1}{2}\right)^2} = \sqrt{25 + \frac{1}{4}}$

$= \sqrt{\frac{101}{4}} = 5.02$

distance of (0, 0) & $\left(-6, \frac{5}{2}\right)$ is $\sqrt{36 + \frac{25}{4}} = 6.5$

Thus, $\left(-6, \frac{5}{2}\right)$ lies on the circle not inside the circle.

8. If (1 – p) is a root of the equation $x^2 + px + 1 - p = 0$, its roots are

(a) 0, –1 (b) –1, 1 (c) 0, 1 (d) –1, 2

Ans. ***(a)***

Sol. $\because$ (1 – p) is root of equation $x^2 + px + (1 - p) = 0$

$\Rightarrow (1-p)^2 + p(1-p) + (1-p) = 0$

$(1-p)[1 - p + p + 1] = 0$

$2(1-p) = 0$

$p = 1$

$\Rightarrow x^2 + x = 0$

$x(x+1) = 0$

$x = 0, -1$

9. The median and mode in a frequency distribution are 26 and 29 respectively. The mean is

(a) 27.5 (b) 24.5 (c) 28.4 (d) 25.8

Ans. ***(b)***

Sol. Given median = 26

mode = 29

we know that $\Rightarrow$ 3 median = mode + 2 mean

$3(26) = 29 + 2\text{mean}$

$\text{mean} = \dfrac{(3\times 26)-29}{2}$

$= 24.5$

10. If the mean of $x_1, x_2, x_3 \ldots, x_{10}$ is 20, then mean of $x_1 + 4, x_2 + 8, x_3 + 12, \ldots, x_{10} + 40$ is

(a) 42 (b) 24 (c) 40 (d) 60

Ans. ***(a)***

Sol. Given, $\dfrac{x_1 + x_2 + \ldots + x_{10}}{10} = 20$

$x_1 + x_2 + \ldots + x_{10} = 200$ ...(1)

Now $\Rightarrow \dfrac{x_1 + 4 + x_2 + 8 + x_3 + 12 + \ldots + x_{10} + 40}{10}$

$\Rightarrow \dfrac{(x_1 + x_2 + x_3 + \ldots + x_{10}) + (4 + 8 + 12 + \ldots + 40)}{10}$

$= \dfrac{200 + \left[\dfrac{10}{2}[(2\times 4) + (10-1)4]\right]}{10}$ $\left\{Sn = \dfrac{n}{2}(2a + (n-1)d)\right\}$

$= \dfrac{200 + 220}{10} = 42$

11. If 'a' is x% more than 'b' and 'b' is y% less than 'a' then relation between x and y is

(a) $\dfrac{1}{x} + \dfrac{1}{y} = \dfrac{1}{100}$ (b) $\dfrac{1}{y} - \dfrac{1}{x} = \dfrac{1}{100}$ (c) $\dfrac{1}{x} - \dfrac{1}{y} = 100$ (d) $\dfrac{1}{y} - \dfrac{1}{x} = 100$

Ans. ***(b)***

Sol. $a + \dfrac{x}{100}\, a = b \quad \Rightarrow a\left(1 + \dfrac{x}{100}\right) = b$ ...(1)

$b - \dfrac{y}{100}\, b = a \quad \Rightarrow b\left(1 - \dfrac{y}{100}\right) = a$ ...(2)

from (1) & (2)

$b\left(1 - \dfrac{y}{100}\right) = \dfrac{b}{1 + \dfrac{x}{100}}$

$\left(1 + \dfrac{x}{100}\right)\left(1 - \dfrac{y}{100}\right) = 1$

$1 - \dfrac{y}{100} + \dfrac{x}{100} - \dfrac{xy}{10000} = 1$

$\dfrac{xy}{10000} = \dfrac{x}{100} - \dfrac{y}{100}$

$\dfrac{xy}{100} = x - y \Rightarrow \dfrac{1}{100} = \dfrac{x-y}{xy}$

$\dfrac{1}{100} = \dfrac{1}{y} - \dfrac{1}{x}$

12. The number '34' is divided into two parts such that $\frac{4}{7}$th of the first part is equal to $\frac{2}{5}$th of the second part. The numbers are

(a) 20, 14 (b) 21, 13 (c) 13, 21 (d) 14, 20

Ans. ***(d)***

Sol. Let 34 be divided in to two parts a and b.

$\therefore$ $a + b = 34$ ...(1)

According to question

$$\frac{4}{7}a = \frac{2}{5}b$$

$$a = \frac{7}{4} \times \frac{2}{5}\ b = \frac{7b}{10}$$

Subsituting the value in equation (1)

$$\frac{7b}{10} + b = 34$$

$$b = \frac{34 \times 10}{17} = 20$$

$\therefore$ $a = 14$

13. The volume of a regular tetrahedron of side 'a' is

(a) $\frac{\sqrt{2}}{4}a^3$ (b) $\frac{\sqrt{2}}{12}a^3$ (c) $\frac{\sqrt{3}}{4}a^3$ (d) $\frac{\sqrt{3}}{12}a^3$

Ans. ***(b)***

Sol. Volume of tetrahedron when side is 'a'

$$V = \frac{\sqrt{2}}{12}a^3$$

14. The arc length of the sector of a circle of radius R which makes an angle x° at the centre is

(a) $\frac{2\pi Rx}{360}$ (b) $\frac{2\pi Rx}{180}$ (c) $\frac{\pi R^2 x}{180}$ (d) $\frac{\pi R^2 x}{360}$

Ans. ***(a)***

Sol. Arc Length L is given by

$$L = 2p\pi\ \frac{\theta}{360^\circ}$$

$$= \frac{2\pi Rx}{360}$$

15. If $a \cos\theta - b \sin\theta = c$, the value of $a \sin\theta + b \cos\theta$ is

(a) $\pm\sqrt{a^2 + b^2 + c^2}$ (b) $\pm\sqrt{a^2 + b^2 - c^2}$ (c) $\pm\sqrt{c^2 - a^2 - c^2}$ (d) $\pm\sqrt{a^2 - b^2 + c^2}$

Ans. ***(b)***

Sol. Given

$a \cos\theta - b \sin\theta = c$ ...(1)

let $a \sin\theta + b \cos\theta = k$ ...(2)

squaring and adding equation (1) & (2)

$a^2 + b^2 = c^2 + k^2$

$$k = \pm\sqrt{a^2 + b^2 - c^2}$$

16. The smallest positive solution of the equation $(81)^{\sin^2 x} + (81)^{\cos^2 x} = 30$ is

(a) $\frac{\pi}{12}$ (b) $\frac{\pi}{8}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$

Ans. ***(d)***

Sol. $(81)^{\sin^2 x} + (81)^{\cos^2 x} = 30$

$(81)^{1-\cos^2 x} + (81)^{\cos^2 x} = 30$

$$\frac{81}{(81)^{\cos^2 x}} + (81)^{\cos^2 x} = 30$$

Let $(81)^{\cos^2 x} = t$

$$\frac{81}{t} + t = 30$$

$t^2 - 30t + 81 = 0$

$t^2 - 27t - 3t + 81 = 0$

$t(t-27) - 3(t-27) = 0$

$(t-3)(t-27) = 0$

$t = 3,$	$t = 27$
$81^{\cos^2 x} = 3,$	$81^{\cos^2 x} = 27$
$3^{4\cos^2 x} = 3,$	$3^{4\cos^2 x} = 3^3$
$\cos x = \frac{1}{2},$	$\cos x = \frac{\sqrt{3}}{2}$
$x = 30°,$	$x = 60°$
$= \frac{\pi}{6},$	$= \frac{\pi}{3}$

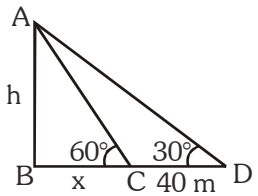
Smallest positive solution $= \frac{\pi}{6}$

17. The angle of elevation of the Sum decreases from 60° to 30°, the length of the shadow of a vertical post increased by 40m. The height of the post is

(a) $10\sqrt{3}$ m (b) $15\sqrt{3}$ m (c) $5\sqrt{3}$ m (d) $20\sqrt{3}$ m

Ans. ***(d)***

Sol.



Let AB be the post and CD = 40 m

$\tan 60° = \frac{h}{x}$

$h = \sqrt{3}x \quad \Rightarrow x = \frac{h}{\sqrt{3}}$

$\tan 30° = \frac{h}{x+40}$

$\frac{1}{\sqrt{3}} = \frac{h}{x+40}$

$\frac{1}{\sqrt{3}} = \frac{h}{\frac{h}{\sqrt{3}}+40}$

$\frac{1}{\sqrt{3}} = \frac{\sqrt{3}h}{h+40\sqrt{3}}$

$2h = 40\sqrt{3}$

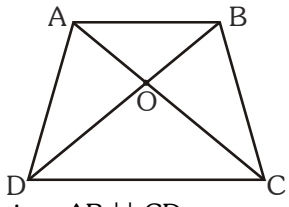
$h = 20\sqrt{3}$

18. ABCD is a trapezium whose AB || CD and diagonals AC and BD intersects at 'O' such that $\overline{OA}$ = (3x – 1) cm, $\overline{OB}$ = (2x + 1) cm, $\overline{OC}$ = (5x – 3) cm and $\overline{OD}$ = (6x – 5) cm. The value of x is

(a) 2 (b) $\frac{1}{2}$ (c) 3 (d) 4

Ans. ***(a)***

Sol.



since AB || CD

$\Delta OAB \sim \Delta OCD$

$$\frac{OA}{OC} = \frac{OB}{OD}$$

$$\frac{3x-1}{5x-3} = \frac{2x+1}{6x-5}$$

$(3x – 1)(6x – 5) = (2x + 1)(5x – 3)$

$18x^2 – 15x – 6x + 5 = 10x^2 – 6x + 5x – 3$

$8x^2 – 20x + 8 = 0$

$2x^2 – 5x + 2 = 0$

$2x^2 – 4x – x + 2 = 0$

$2x(x – 2) – 1(x – 2) = 0$

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

for $x = \frac{1}{2}$, side will be negative

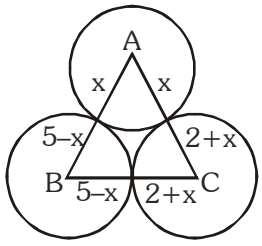
$\Rightarrow x = 2$

19. Three circles with centres A, B, C respectively touch each other externally. If $\overline{AB}$ = 5 cm. $\overline{BC}$ = 7 cm and $\overline{CA}$ = 6 cm, the radius of the circle with centre A is

(a) 1.5 cm (b) 2 cm (c) 2.5 cm (d) 3 cm

Ans. ***(b)***

Sol.



AB = 5 cm

BC = 7 cm

CA = 6 cm

Let radius of circle with centre at A is x

Then, Radius of circle with centre B = 5 – x

$\Rightarrow$ Radius of circle with centre C = 7 – (5 – x)

= 2 + x

Now AC = x + 2 + x

6 = 2 + 2x

4 = 2x

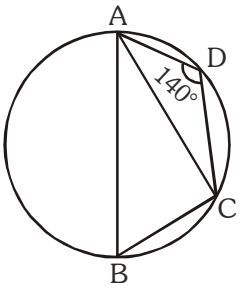
x = 2

20. ABCD is a cyclic quadrilateral such that side $\overline{AB}$ is the diameter of the circle and $\angle ADC = 140°$. The value of $\angle BAC$ is

(a) 40° (b) 45° (c) 50° (d) 60°

Ans. ***(c)***

Sol.



$\angle ABC + 140° = 180°$

$\angle ABC = 40°$

$\angle ACB = 90°$

In ΔABC

$\angle ABC + \angle ACB + \angle BAC = 180°$

$40° + 90° + \angle BAC = 180°$

$\angle BAC = 50°$

21. A player completes a circular path of radius 'r' in 40 sec. At the end of 2 min. 20 sec what will be the magnitude of his displacement ?

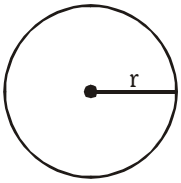
(a) 2 r (b) $2\pi r$ (c) $9\pi r$ (d) Zero

Ans. ***(a)***

Sol. Total time = 2 min 20 sec = 140 sec

time for one complete circle = 40 sec

In 120 sec, no of rounds completed = $\frac{140}{40} = 3.5$



At the end of 3rd round displacement is zero

For last semicirle, displacement = diameter of circle = 2r

22. A body is thrown up vertically upwards with a velocity u. It covers a maximum height of h. If air resistance is neglected, h is given by (take g = acceleration due to gravity).

(a) $\frac{u^2}{2g}$ (b) $\frac{u}{2g}$ (c) 2 u g (d) $\frac{u^2}{g}$

Ans. ***(a)***

Sol. When a body is thrown up, v = 0 at maximum height

$v^2 = u^2 + 2a\,s$

$0 = u^2 - 2gh$

$u^2 = 2gh$

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

23. A man walks 8m towards east and then 6m towards north. The magnitude of his displacement is

(a) 10 m (b) 14 m (c) 2 m (d) 0 m

Ans. ***(a)***

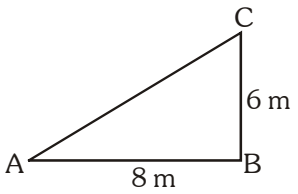
Sol. Displacement = AC

According to pythagoreas theorem

$AC = \sqrt{(AB)^2 + (BC)^2}$

$AC = \sqrt{64 + 36}$

AC = 10 m



24. The time period of a simple pendulum (for small angular amplitude) depends on

(a) mass of the bob (b) effective length of the pendulum

(c) volume of the bob (d) mass and volume of the bob

Ans. ***(b)***

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

$\therefore$ T depends of effective length of pendulum

25. Fill in the blank

$_{92}U^{235} + {}_0n^1 \rightarrow {}_{56}Ba^{139} + \text{——} + 3{}_0n^1 + \text{Energy.}$

(a) $_{36}Kr^{94}$ (b) $_{36}Kr^{95}$ (c) $_{36}Kr^{93}$ (d) $_{36}Kr^{96}$

Ans. ***(a)***

Sol. $_{92}U^{235} + {}_0n' \rightarrow {}_{56}Ba^{139} + \longrightarrow + 3\ {}_0n^1$

Atomic no. of element = 92 – [56 + 3]

$\Rightarrow$ 92 – 56

$\Rightarrow$ 36

Mass no. of element = (235 + 1) – (139 + 3)

= 236 – 142

= 94

26. A car moving with a speed of 50 km/h can be stopped safely by brakes over a minimum distance of 6 m. If it moves at a speed of 100 km/h what will be the minimum distance of stopping safely ?

(a) 12 m (b) 18 m (c) 6 m (d) 24 m

Ans. ***(d)***

Sol. Given u = 50 km/hr, s = 6 m, v = 0

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

$0 = (50)^2 - 2 \times a \times (6 \times 10^{-3})$

$$\frac{50 \times 50 \times 1000}{2 \times 6} = a$$

Now, u = 100 km/hr, s = ? , v = 0

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

$$0 = (100)^2 \times 2 \times \left(\frac{50 \times 50 \times 1000}{2 \times 6}\right)s$$

$$100 \times 100 = \frac{50 \times 50 \times 1000}{6}s$$

$$\frac{100 \times 100 \times 6}{50 \times 50 \times 1000} = s$$

24×10^{-3} km = s

s = 24 m

27. Two bodies of masses 4 kg and 5 kg are moving with equal momentum. The ratio of their respective Kinetic Energy will be

(a) $\sqrt{4} : \sqrt{5}$ (b) 16 : 25 (c) 25 : 16 (d) 5 : 4

Ans. ***(d)***

Sol. Given $m_1 = 4$ kg, $m_2 = 5$ kg

$P_1 = P_2$

$m_1 v_1 = m_2 v_2$

$$\frac{v_1}{v_2} = \frac{5}{4}$$

$$\frac{KE_1}{KE_2} = \frac{m_1 v_1^2}{m_2 v_2^2}$$

$$\frac{4}{5} \times \frac{25}{16} = \frac{5}{4}$$

28. Young's Modulus of the material of wire of length 'L' and radius 'r' is Y $\frac{N}{m^2}$. If the length is reduced to $\frac{L}{2}$ and the radius is reduced to $\frac{r}{2}$, what will be its Young's Modulus ?

(a) Y (b) 2Y (c) $\frac{Y}{4}$ (d) $\frac{Y}{2}$

Ans. ***(a)***

Sol. Young's modulus is property of material. It does not depend on length and radius of wire.

29. An ice cube of density 900 kg/m^3 is floating in water of density 1000 kg/m^3. The percentage of ice volume which remain outside water is

(a) 20% (b) 80% (c) 10% (d) 90%

Ans. ***(c)***

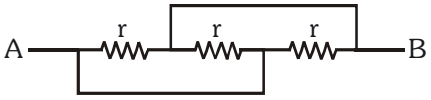
Sol. Volume of ice outside $= 1 - \frac{\rho_s}{\rho_w}$

$$= 1 - \frac{900}{1000}$$

$$= \frac{1000 \times 900}{1000} = \frac{100}{1000}$$

Now percentage $= \frac{1}{10} \times 100 = 10\%$

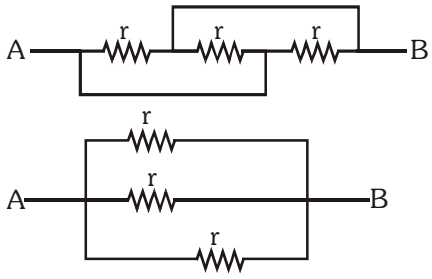
30. Three resistances each equal to 'r' are connected as shown in the adjacent fig. The equivalent resistance between A and B is



(a) r (b) 3r (c) $\frac{r}{3}$ (d) $\frac{2r}{3}$

Ans. ***(c)***

Sol.



$$= \frac{1}{R} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r}$$

$$\frac{1}{R} = \frac{3}{r}$$

$$R = \frac{r}{3}$$

31. The number of β-particles emitted by a radioactive atom is twice the number of α-particles emitted by it. The resulting daughter atom is an _____of the parent atom. (Fill in the blank)

(a) isobar (b) isomer (c) isotone (d) isotope

Ans. ***(d)***

Sol. Symbol of β particle is $_{-1}e^0$

Symbol of α particle is $_2He^4$

Emitted B particles are double of α particles. Emitted β particles = $2_{-1}e^0$

On equating we get no change in atomic number. Only mass number changes, thus it is an isotope.

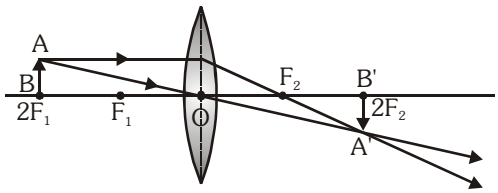
32. If ' f ' be focal length of a convex lens, then the minimum distance between the object and its real image is given by

(a) 2.5 f (b) 2 f (c) 4 f (d) f

Ans. ***(c)***

Sol. Mininum distance between object and image (real) is when object is kept of c

Image is formed C'



Now distance = 2f + 2f

= 4f

33. The velocity of sound in a gas having temperature T in Kelvin scale is given by v, then

(a) $v \propto T$ (b) $v \propto \sqrt{T}$ (c) $v \propto \frac{1}{T}$ (d) $v \propto \frac{1}{\sqrt{T}}$

Ans. ***(b)***

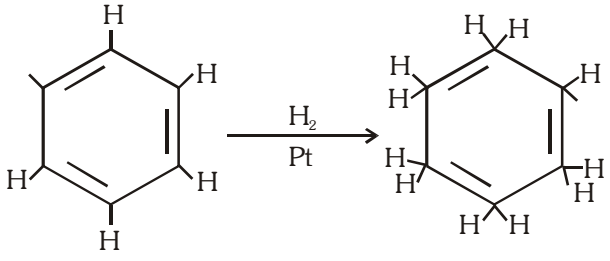
Sol. Velocity of sound is directly proportional $\sqrt{T}$.

34. How many new sigma bonds will be formed when benzene is completely hydrogenated using Pt/H_2?

(a) 3 (b) 4 (c) 5 (d) 6

Ans. ***(d)***

Sol.



6 new sigma bonds

35. In the ideal gas equation $PV = \frac{W}{M}RT$, the quantity 'M' stands for -

(a) Number of moles of the gas
(b) Molecular weight of the gas.
(c) Gram molecular mass of the gas.
(d) Mass of the gas in grams.

Ans. ***(b)***

Sol. $PV = \frac{W}{M}RT$

$$PV = \frac{\text{Weight in gram}}{\text{Molecular weight of gas}}RT$$

$\therefore$ {M = Molecular wight of gas}

36. Which one is an example of a Redox reaction ?

(a) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$
(b) $CaCO_3 \rightarrow CaO + CO_2$
(c) $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$
(d) $NaH + H_2O \rightarrow NaOH + H_2$

Ans. ***(d)***

Sol. $\overset{-1}{NaH} + H_2O \longrightarrow NaOH + \overset{0}{H_2}$

37. What is the pH of a 0.001 M NaOH solution ?

(a) 3 (b) 7 (c) 11 (d) 12

Ans. ***(c)***

Sol. pOH = – log [0.001]

$= -\log[1\times10^{-3}]$

$= 3 \log 10$

pOH = 3

pH = 14–3

$\boxed{pH = 11}$

38. An ion having a Mass number 52 has 3 units of positive charge. The number of neutrons in the ion exceeds the number of electrons in it by 7. The Atomic number of the element is

(a) 28 (b) 22 (c) 26 (d) 24

Ans. ***(d)***

Sol. number of protons = x

number of electrons = x – 3

number of neutrons = x – 3 + 7 = x + 4

mass number = numer of protons + number of neutrons

x + x + 4 = 52

2x + 4 = 52

2x = 52 – 4

$x = \frac{48}{2} = 24$

Atomic number = number of protons (x) = 24

39. 0.2 gm of an organic compound on complete oxidation produces 0.18 gm of water. The percentage of hydrogen in the organic compound is

(a) 5 (b) 10 (c) 15 (d) 20

Ans. ***(b)***

Sol. 18 gm $H_2O \longrightarrow 2gm\ N_2$

$0.18\ gm\ H_2O \longrightarrow \frac{2}{18} \times 0.18 = \frac{1}{50} = 0.02\ H_2$

$\%$ of H_2 in organic compound $\longrightarrow \frac{0.02}{0.2} \times 100$

$= 10\%$

40. The maximum number of molecules present in

(a) 15 L H_2 gas at STP (b) 5 L N_2 gas at STP

(c) 0.5 gm H_2 gas (d) 10 gm O_2 gas

Ans. ***(a)***

Sol. $\text{Mole} = \frac{15}{22.4} = 0.66$

$\Rightarrow$ No of Molecules $= 0.6696 \times 6.023 \times 10^{23}$

$= 4.033 \times 10^{23}$

41. Which of the following polymers contains Fluorine ?

(a) Neoprene (b) PVC (c) Teflon (d) Polyester

Ans. ***(a)***

Sol. Teflon $\rightarrow$ Tetra fluoro ethane $(C_2F_4)_n$

42. A mixture ethylene, methane and propene was passed through cold, concentrated sulphuric acid. Which gas/gases will come out unreacted?

(a) Methane (b) Ethylene and Methane

(c) Propene and Ethylene (d) Propene

Ans. ***(a)***

Sol. Methane (Saturated Hydrocarbon) does not show addition reaction.

43. Which of the following orders of ionic radii is correctly represented ?

(a) $O^{2-} > N^{3-} > Al^{3+} > Mg^{2+}$ (b) $Al^{3+} > O^{2-} > N^{3-} > Mg^{2+}$

(c) $N^{3-} > O^{2-} > Mg^{2+} > Al^{3+}$ (d) $N^{3-} > Al^{3+} > Mg^{2+} > O^{2-}$

Ans. ***(c)***

Sol. For isoelectronic species

radius of cation $\propto \frac{1}{Z}$ radius of anion $\neq Z$

Z = charge on species

44. ${}^{a}_{b}X$ and ${}^{c}_{d}Y$ are isotopes. Which equation is correct regarding the two atoms ?

(a) (b + d) (a – c) = 0 (b) (b – d) (a + c) = 0

(c) (b + d) (a + c) = 0 (d) (b + a) (d + c) = 0

Ans. ***(b)***

Sol. I in ${}^{a}_{b}X\ {}^{c}_{d}Y$ b = d(atomic number)

then (b – d) = 0

So $0 \times (a + c) = 0$

So ans (b) is correct

45. Among HCl, HBr, HF and HNO_3 which one will form acidic salt ?

(a) HCl (b) HBr (c) HF (d) HNO_3

Ans. ***(c)***

Sol. HF exists as H_2F_2, forms KHF_2 salt which is acidic in nature.

46. During the extraction of Al which one of the following is mixed with Al_2O_3?

(a) $CuSO_4$, H_2O (b) Na_3AlF_6 (c) $NaAlO_2$ (d) SiO_2

Ans. ***(b)***

Sol. Na_3AlF_6 (Cryolite) is mixed due to decrease the melting point of Al_2O_3 (Pure aluminia).

47. Which one of the following sets of animals have four chambered heart ?

(a) Amphibia, Reptilia, Bird (b) Crocodile, Bird, Mammal

(c) Crocodile, Lizard, Turtle (d) Lizard, Mammal, Bird

Ans. ***(b)***

Sol. Crocodile, Bird, Mammals have four chambered heart. Crocodile is the only reptile that has 4 chambered heart.

48. Mesophyll cells in a leaf are constructed by

(a) Parenchyma tissue (b) Collenchyma tissue (c) Sclerenchyma tissue (d) Meristematic tissue

Ans. ***(a)***

Sol. Mesophyll cells in a leaf are made up of parenchyma tissue

49. Name of the structural unit of DNA is

(a) Nucleoside (b) Nucleosome (c) Nucleotide (d) Nucleoprotein

Ans. ***(c)***

Sol. DNA is a polynucleotide chain so its structural unit is nucleotide. Nucleotide is made up of pentose sugar, nitrogenous base and phosphate group.

50. Nuclear membrane is

(a) double layered and porous (b) double layered and non-porous

(c) single layered and porous (d) single layered and non-porous

Ans. ***(a)***

Sol. Nuclear membrane is double layered and porous.

51. Anti-haemophilic Factor is

(a) Factor VII (b) Factor VIII (c) Factor X (d) Factor XII

Ans. ***(b)***

Sol. Factor VIII, a type of blood clotting factor is also known as antihaemophilic factor, Human body has 13 types of blood clotting factors.

52. During deficiency of oxygen in tissues of man, pyruvic acid is converted into lactic acid in the

(a) Chloroplast (b) Golgi body (c) Cytoplasm (d) Mitochondria

Ans. ***(c)***

Sol. During vigorous exercise, lack of oxygen occurs in humnan body that causes anaerobic respiration in muscle cells in which pyruvic acid is converted into lactic acid. This step takes place in cytoplasm of the cell.

53. A doctor advised a person to take an injection of insulin because

(a) he was suffering from goitre (b) his blood pressure was low

(c) his sugar level in blood was high (d) his heart was beating slowly

Ans. ***(c)***

Sol. Injection of insulin hormone is advised by the doctor in case of diabetes because in diabetic patient sugar level in blood becomes high due to lack of insulin secretion.

54. The correct sequence of reproductive stages in flowering plant is

(a) Gametes, Zygote, Embryo, Seedling (b) Zygote, Gametes, Embryo, Seedling

(c) Seedling, Zygote, Embryo, Gametes (d) Embryo, Zygote, Gametes, Seedling

Ans. ***(a)***

Sol. Reproductive stages in flowering plant occurs as gametes → Zygote → embryo → seedling.

55. Select the eco-friendly activity among the following :

(a) Using dyes for colouring clothes. (b) Using polybags for shopping.

(c) Using car for transportation. (d) Using windmills to generate power for irrigation.

Ans. ***(d)***

Sol. Use of windmills to generate power for irrigation is an ecofriendly activity as it causes less pollution in environment.

56. The letter 'B' in the name BCG vaccination stands for

(a) Beriberi (b) Bacteria (c) Bacillus (d) Blood

Ans. ***(c)***

Sol. Letter 'B' in name of vaccine BCG stands for Bacillus (shape of a bacteria). This vaccine is injected against tuberculosis that is caused by a bacteria.

57. Which one out of the organs listed below, most actively functions in regulating our body temperature ?

(a) Stomach (b) Heart (c) Skin (d) Lungs

Ans. ***(c)***

Sol. Skin most actively functions in regulating our body temperature.

58. The type of joint found at shoulder is also found at

(a) Knee (b) Elbow (c) Ankle (d) Hip

Ans. ***(d)***

Sol. Joint found at shoulder and hip is ball and socket joint.

59. Which one of the following pairs of nutrients includes both as simple sugars (monosaccharides) ?

(a) Glucose and Maltose (b) Glucose and Fructose

(c) Sucrose and Glucose (d) Maltose and Lactose

Ans. ***(b)***

Sol. Glucose and fructose are monosaccharides. Both are 6 carbon sugars.

60. If a grasshopper is eaten by a frog, then the energy transfer will be from

(a) primary consumer to secondary consumer. (b) secondary consumer to primary consumer.

(c) producer to primary consumer. (d) producer to decomposer.

Ans. ***(a)***

Sol. Grasshopper → Frog

Grass i.e. producer eaten by grasshopper i.e. primary consumer and grasshopper eaten by frog i.e. secondary consumer, so here energy transfer is from primary consumer to secondary consumer.

61. 'Social Contract' was written by

(a) Montesquieu (b) Voltaire (c) Rousseau (d) Vincent Smith

Ans. ***(c)***

Sol. The Social Contract, or Principles of Political Right by Jean-Jacques Rousseau, is a book in which Rousseau theorized about the best way to establish a political community in the face of the problems of commercial society.

62. The Vienna Settlement was held in

(a) 1807 AD (b) 1813 AD (c) 1815 AD (d) 1819 AD

Ans. ***(c)***

Sol. The Congress of Vienna was a conference of ambassadors of European states chaired by Austrian statesman Metternich, and held in Vienna from in 1815.

63. February Revolution (1848) was held in

(a) England (b) France (c) Germany (d) Italy

Ans. ***(b)***

Sol. The 1848 Revolution in France, sometimes known as the February, was one of a wave of revolutions in 1848 in Europe.

64. 'Blood and Iron' policy was introduced by

(a) Metarnich (b) Cavour (c) Gariboldi (d) Bismarck

Ans. ***(d)***

Sol. Blood and Iron is the title of a speech by Minister President of Prussia Otto von Bismarck given in 1862 about the unification of the German territories. It is also a transposed phrase that Bismarck uttered near the end of the speech that has become one of his most widely known quotations.

65. The book named 'Sabdakalpadrum' was written by

(a) Rammohan Roy (b) Radhakanta Dev (c) Vidyasagar (d) Swami Vivekananda

Ans. ***(b)***

Sol. Sabda Kalpadrum is a well known Sanskrit lexicon compiled by a few Bengali scholars at the instance of Raja Radhakanta Deb of Bengal.

66. 'Bangabhasha Prakashika Sabha' was established in

(a) 1832 AD (b) 1834 AD (c) 1836 AD (d) 1838 AD

Ans. ***(c)***

Sol. The first political association was called the Bangabhasha Prakashika Sabha formed in 1836.

67. The editor of 'Bangadarshan' magazine was

(a) Surendranath Banerjee (b) Krishna Kumar Mitra

(c) Keshab Chandra Sen (d) Bankim Chandra Chattopadhyay

Ans. ***(d)***

Sol. Bangadarshan was a Bengali literary magazine, founded by Bankim Chandra Chattopadhyay in 1872.

68. Buddha Bhagat was the leader of

(a) Kol Rebellion (b) Santhal Rebellion (c) Munda Rebellion (d) Bhil Rebellion

Ans. ***(a)***

Sol. Kol revolt took place under the leadership of Budha Bhagat.

69. Indian Association for the Cultivation of Science was founded by

(a) Dr. Nil Ratan Sarkar (b) Acharya Prafulla Chandra Roy

(c) Dr. Mahendralal Sarkar (d) Jagadish Chandra Bose

Ans. ***(c)***

Sol. Indian Association for the Cultivation of Science is an institute of higher learning in Kolkata, India. Established in 1876 by Mahendra Lal Sarkar, a private medical practitioner, it focuses on fundamental research in basic sciences.

70. Chauri Choura incident took place in

(a) 1920 AD (b) 1922 AD (c) 1925 AD (d) 1929 AD

Ans. ***(b)***

Sol. The Chauri Chaura incident occurred at Chauri Chaura in the Gorakhpur district of the United Province, British India on 4 February 1922, when a large group of protesters, participating in the Non-cooperation movement, clashed with police, who opened fire.

71. Poona Pact (1932) was signed between

(a) Gandhiji and B. R. Ambedkar (b) Gandhiji and Lord Irwin

(c) Gandhiji and Md. Ali Zinnah (d) Gandhiji and Subhash Chandra Bose

Ans. ***(a)***

Sol. The Poona Pact refers to an agreement between B. R. Ambedkar and Mahatma Gandhi signed on 24 September 1932 at Yerwada Central Jail in Pune, India.

72. The first Linguistic State in India was

(a) Bengal (b) Andhra Pradesh (c) Punjab (d) Tamil Nadu

Ans. ***(b)***

Sol. The first state created on a linguistic basis was Andhra in 1953, created out of the Telugu-speaking northern parts of Madras State.

73. Marbel is an example of

(a) Igneous rock (b) Sedimentary rock (c) Metamorphic rock (d) None of the above

Ans. ***(c)***

Sol. Marble is a metamorphic rock that may be foliated or non-foliated, composed of recrystallized carbonate minerals, most commonly calcite or dolomite.

74. 'Block disintegration' is a _____ type of weathering.

(a) chemical (b) mechanical (c) biological (d) None of the above

Ans. ***(b)***

Sol. Block disintegration is a type of mechanical weathering.

75. Large waterfalls with huge volume of water is known as

(a) Cascade (b) Rapid (c) Cataract (d) Plunge Pool

Ans. ***(c)***

Sol. A waterfall in which a large volume of water flows over a steep precipice.

76. Jet plane moves into

(a) Troposphere (b) Stratosphere (c) Mesosphere (d) None of the above

Ans. ***(b)***

Sol. Commercial jet planes fly in the lower stratosphere to avoid turbulence.

77. Cold Hamboldt current flows along the coast of

(a) Peru (b) California (c) Newfoundland (d) Australia

Ans. ***(a)***

Sol. The Humboldt Current is a cold, low-salinity ocean current that flows north along the west coast of South America from the southern tip of Chile to northern Peru.

78. The plan for 'The Great Green Wall' has been initiated due to

(a) Protect Ganga river pollution (b) Prevent Soil erosion

(c) Prevent desertification (d) Prevent Global warming

Ans. ***(c)***

Sol. The Great Green Wall or Great Green Wall of the Sahara and the Sahel Initiative is a planned project to plant a wall of trees across Africa at the southern edge of the Sahara desert as a means to prevent desertification.

79. The Bundelkhand Plateau in Central Highlands of India is situated in the

(a) Eastern part of Chambal River (b) Northern part of Aravalli Range

(c) North-Eastern part of Malwa Plateau (d) Southern part of Vindhya Range

Ans. ***(a)***

Sol. The Bundelkhand plateau is situated in the Eastern part of the Chambal River.

80. Which of the following is not a characteristic feature of the Black Soil ?

(a) Rich in Nitrogen (b) Richin Aluminium and Magnesium

(c) Poor in Humus (d) Originated from Basalt

Ans. ***(a)***

Sol. Alluvial soil is rich in nitrogen , not black soil.

81. Who is the father of 'Green Revolution' in India ?

(a) M. S. Swaminathan (b) N. Borlaug (c) V. Kurien (d) H. Choudhuri

Ans. ***(a)***

Sol. M.S Swaminathan is considered as the father of Green Revolution in India.

82. India's first petrochemical industry is

(a) UCIL (b) NOCIL (c) HPL (d) MPL

Ans. ***(c)***

Sol. HPL was India's first petrochemical industry founded in 1957.

83. Khardungla, the world's highest motorable Pass, is situated in

(a) Karakoram Range (b) Ladakh Range (c) Zanskar Range (d) Pirrpanjal Range

Ans. ***(b)***

Sol. Khardung La is a mountain pass located in the Ladakh region of the Indian state of Jammu and Kashmir.

84. The scale of 15'/15' Topographical Sheet is

(a) 1 : 1000000 (b) 1 : 250000 (c) 1 : 100000 (d) 1 : 50000

Ans. ***(b)***

Sol. The topographical maps of India are prepared on 1 : 10,00,000, 1 : 250,000, 1 : 1,25,000, 1 : 50,000 and 1 : 25,000 scale providing a latitudinal and longitudinal coverage of 4° x 4°, 1° x 1°, 30' x 30', 15' x 15' and 5' x 7' 30", respectively.

85. The book 'Polities' is written by

(a) Plato (b) Green (c) Aristotle (d) Laski

Ans. ***(c)***

Sol. Author of Politics - Aristotle

86. The special status of the state of Jammu and Kashmir is granted by the following provision of the Constitution of India

(a) Article No. 360 (b) Article No. 370 (c) Article No. 352 (d) Article No. 356

Ans. ***(b)***

Sol. Article 370 of the Indian constitution is an article that grants special autonomous status to the state of Jammu and Kashmir. The article is drafted in Part XXI of the Constitution, which relates to Temporary, Transitional and Special Provisions.

87. The Father of Non-Aligned Movement was

(a) Indira Gandhi (b) Sukarno (c) Marshall Tito (d) Jawaharlal Nehru

Ans. ***(d)***

Sol. The Non-Aligned Movement (NAM) is a group of states that are not formally aligned with or against any major power bloc. As of 2012, the movement has 120 members. The organization was founded in Belgrade in 1961, and was largely conceived by India's first prime minister, Jawaharlal Nehru, who is also known as the father of this movement.

88. The first summit meeting of SAARC was held at

(a) Dhaka (b) Colombo (c) Delhi (d) Islamabad

Ans. ***(a)***

Sol. The first SAARC summit was held in Dhaka (Bangladesh) in December 1985.

89. The President of the Drafting Committee of the formation of the Indian Constitution was

(a) Jawaharlal Nehru (b) K M. Munshi (c) Dr. Ambedkar (d) Dr. Rajendra Prasad

Ans. ***(c)***

Sol. Dr. Ambedkar was the chairman of the Drafting Committee of India.

90. The name of the Legislature of the United States of America is

(a) Parliament (b) Duma (c) Diet (d) Congress

Ans. ***(d)***

Sol. The United States Congress is the bicameral legislature of the federal government of the United States consisting of two chambers: the Senate and the House of Representatives.

91. The 'Human Rights Day' is observed in the world on

(a) 10th December (b) 24th October (c) 9th August (d) 5th June

Ans. ***(a)***

Sol. Human Rights Day is observed every year on 10 December. It commemorates the day on which, in 1948, the United Nations General Assembly adopted the Universal Declaration of Human Rights.

92. In present India the total number of states are

(a) 25 (b) 28 (c) 29 (d) 30

Ans. ***(c)***

Sol. Total number of states in India are now 29, after the addition of Telangana.

93. "Laissez-faire" is closely related to

(a) Capitalism (b) Socialism (c) Mixed economy (d) Rationing system

Ans. ***(a)***

Sol. Laissez Faire Capitalism. "Laissez Faire" is French for "leave alone" which means that the government leaves the people alone regarding all economic activities. It is the separation of economy and state. There are two ways that a government typically is tempted to interfere with the economy.

94. The policy with which the government tries to cope up with the situation of recession is

(a) Contractionary policy (b) Expansionary policy

(c) Pricing policy (d) Health care policy

Ans. ***(b)***

Sol. With the help of Expansionary Policy, the government tries to cope up with the situation of recession.

95. Government fixes maximum price in the interest of

(a) Consumers (b) Producers (c) Traders (d) All of the above

Ans. ***(a)***

Sol. Government fixes maximum prices in the interest of the consumers.

96. Which of the following is not a determining factor of the supply of a commodity ?

(a) Price of the commodity (b) Income of the consumers

(c) Prices of the factors of production (d) Technology

Ans. ***(b)***

Sol. Income of the consumers is not a determining factor of the supply of a commodity.

97. Which type of income is earned through production ?

(a) Pension (b) Unemployment allowances

(c) Rent of land (d) Grant

Ans. ***(c)***

Sol. Rent of land is an income earned through production.

98. Public distribution system in India is an important instrument of

(a) Expansion of demand (b) Supply of essential commodities to consumers

(c) Supply of luxury goods to consumers (d) Increased import substitution

Ans. ***(b)***

Sol. Public Distribution System helps in supplying essential commodities to the consumers.

99. Which of the following is an indirect tax ?

(a) Excise duty (b) Capital gains tax (c) Income tax (d) Gift tax

Ans. ***(a)***

Sol. Excise duty is a form of direct tax.

100. Life Insurance Corporation of India (LIC) is a

(a) Bank (b) Non-Bank Financial Institution

(c) Development Bank (d) Rural Bank

Ans. ***(b)***

Sol. LIC of India is a Non Bank Financial Institution.