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

STATE : WEST BENGAL PAPER : SAT

Date: 17/11/2019

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

1. If $23x - 29y = 98$ and $29x - 23y = 110$, then the value of $\sqrt{x^2 + y^2}$ is

(a) $\sqrt{10}$ (b) $\sqrt{5}$ (c) 10 (d) 7

Ans. ***(a)***

Sol. $23x - 29y = 98$ ... (1)

$29x - 23y = 110$ ... (2)

equation (1) and equation (2)

$52(x - y) = 208$

$x - y = 4$ ... (3)

equation (1) and equation (2)

$-6x - 6y = -12$

$x + y = 2$ ... (4)

equation (3) and equation (4)

$x = 3$

$y = -1$

$$\sqrt{x^2 + y^2} = \sqrt{(3)^2 + (-1)^2} = \sqrt{10}$$

2. If $x = \frac{y}{y+1}$ and $y = \frac{a-2}{2}$, then the value of $x(y + 2) + \frac{x}{y} + \frac{y}{x}$ is

(a) 1 (b) 0 (c) –1 (d) a

Ans. ***(d)***

Sol. $x = \frac{y}{y+1}$, $y = \frac{a-2}{2}$

$$x = \frac{\frac{a-2}{2}}{\left(\frac{a-2}{2} + 1\right)} = \frac{a-2}{a}; \quad y = \frac{a-2}{2}$$

$$\& \quad \frac{x}{y} = \frac{\left(\frac{a-2}{a}\right)}{\left(\frac{a-2}{2}\right)} = \frac{2}{a}$$

$$\therefore \quad x(y+2)+\frac{x}{y}+\frac{y}{x}=xy+2x+\frac{x}{y}+\frac{y}{x}$$

$$=\left(\frac{a-2}{a}\right)\left(\frac{a-2}{2}\right)+2\left(\frac{a-2}{a}\right)+\frac{2}{a}+\frac{a}{2}$$

$$=\frac{(a-2)^2+4(a-2)+4+a^2}{2a}$$

$$=\frac{2a^2}{2a}=a$$

3. If $\sin\theta + \sin^3\theta = \cos^2\theta$, then the value of $\cos^6\theta - 4\cos^4\theta + 8\cos^2\theta$ is

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

Ans. ***(b)***

Sol. $\sin\theta(1+\sin^2\theta) = \cos^2\theta$

$\Rightarrow \sin\theta(2-\cos^2\theta) = \cos^2\theta$

squaring both sides,

$\Rightarrow \sin^2\theta\,(2-\cos^2\theta)^2 = \cos^4\theta$

$\Rightarrow (1-\cos^2\theta)(4+\cos^4\theta-4\cos^2\theta) = \cos^4\theta$

$\Rightarrow 4+\cos^4\theta-4\cos^2\theta-4\cos^2\theta-\cos^6\theta+4\cos^4\theta = \cos^4\theta$

$\Rightarrow \cos^6\theta-4\cos^4\theta+8\cos^2\theta = 4$

4. If $x^2+y^2 = 2\sqrt{2}x+4\sqrt{2}y-10$, then the value of $\frac{x}{y}$ is

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

Ans. ***(a)***

Sol. $x^2+y^2-2\sqrt{2}x-4\sqrt{2}y+10=0$

$$x^2-2\sqrt{2}x+\left(\sqrt{2}\right)^2+y^2-4\sqrt{2}y+\left(2\sqrt{2}\right)^2=0$$

$$\left(x-\sqrt{2}\right)^2+\left(y-2\sqrt{2}\right)^2=0$$

$\Rightarrow x=\sqrt{2},\ y=2\sqrt{2}$

$$\therefore \quad \frac{x}{y}=\frac{\sqrt{2}}{2\sqrt{2}}=\frac{1}{2}$$

5. If $x+y=12$, then the maximum value of xy will be

(a) 20 (b) 30 (c) 36 (d) 40

Ans. ***(c)***

Sol. $x + y = 12$

A.M.$(x,y) \geq$ G.M. (x, y)

$$\frac{x+y}{2} \geq \sqrt{xy}$$

$$\frac{12}{2} \geq \sqrt{xy}$$

$\Rightarrow \quad 6 \geq \sqrt{xy}$

$\Rightarrow \quad xy \leq 36$

Maximum value of $xy = 36$

6. If $\frac{4+\sqrt{5}}{2}$ and $\frac{4-\sqrt{5}}{2}$ be the roots of a quadratic equation, then the quadratic equation will be

(a) $4x^2 - 17x - 9 = 0$ (b) $6x^2 - 16x - 9 = 0$ (c) $x^2 - 5x + 8 = 0$ (d) $4x^2 - 16x + 11 = 0$

Ans. ***(d)***

Sol. $\alpha = \frac{4+\sqrt{5}}{2}, \beta = \frac{4-\sqrt{5}}{2}$

$$\alpha + \beta = \frac{1}{2}\left(4+\sqrt{5}+4-\sqrt{5}\right) = 4$$

$$\alpha\beta = \frac{\left(4+\sqrt{5}\right)\left(4-\sqrt{5}\right)}{4} = \frac{16-5}{4} = \frac{11}{4}$$

Quadratic equation will be :

$$x^2 - 4x + \frac{11}{4} = 0 \Rightarrow 4x^2 - 16x + 11 = 0$$

7. If $\sin^4 x + \sin^2 x = 1$, then the value of $\cot^4 x + \cot^2 x$ will be

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

Ans. ***(b)***

Sol. $\sin^4 x + \sin^2 x = 1$

$\sin^4 x = 1 - \sin^2 x$

$\sin^4 x = \cos^2 x$

$$\Rightarrow \quad \sin^2 x = \frac{\cos^2 x}{\sin^2 x}$$

$\Rightarrow \quad \sin^2 x = \cot^2 x$

$\therefore \quad \cot^4 x + \cot^2 x$

$= \cot^2 x (\cot^2 x + 1)$

$= \sin^2 x (\sin^2 x + 1)$

$= \sin^4 x + \sin^2 x$

$= 1$

8. $\sqrt{a\sqrt{b\sqrt{c\sqrt{d}}}}$ =

(a) $a^{1/2}b^{1/4}c^{1/8}d^{1/16}$ (b) $(abcd)^{1/16}$ (c) $(abcd)^{1/8}$ (d) $a^{1/2}b^{1/2}c^{1/2}d^{1/2}$

Ans. ***(a)***

Sol. $\sqrt{a\sqrt{b\sqrt{c\sqrt{d}}}} = \left(a\left(b\left(c.d^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}} = a^{\frac{1}{2}}.b^{\frac{1}{4}}.c^{\frac{1}{8}}.d^{\frac{1}{16}}$

9. A train goes from Sealdah to Rannghat with velocity 60 km/hr and return from Rannghat to Sealdah with velocity 80 km/hr. The average velocity of the train will be

(a) 70 km/hr (b) $68\frac{4}{7}$ km/hr (c) $70\frac{4}{7}$ km/hr (d) 68 km/hr

Ans. ***(b)***

Sol. Average Velocity $= \frac{\text{Total distance travelled}}{\text{Total time taken}}$

$$= \frac{2d}{\frac{d}{60}+\frac{d}{80}} = \frac{2\times 240}{7}$$

$$= \frac{480}{7}\text{km/hr}$$

$$= 68\frac{4}{7}\text{km/hr}$$

10. The triangle formed by the points (7, 9), (3, –7) and (–3, 3) is

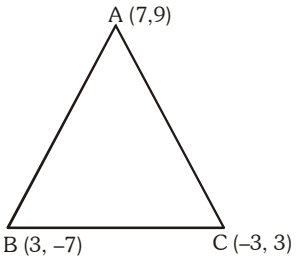
(a) Equilateral (b) Isosceles (c) Scalene (d) Right angled and Isosceles

Ans. ***(d)***

Sol. $AB = \sqrt{(7-3)^2+(9+7)^2} = \sqrt{16+256} = \sqrt{272}$

$BC = \sqrt{(3+3)^2+(-7-3)^2} = \sqrt{36+100} = \sqrt{136}$

$AC = \sqrt{(7+3)^2+(9-3)^2} = \sqrt{36+100} = \sqrt{136}$



Here, BC = AC

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

$\therefore$ ΔABC is isosceles right triangle.

11. In a cuboid the length of the diagonal is p, the sum of areas of all the surfaces is q and the sum of lengths of coinitial edges is r. Then which one of the following relations is true ?

(a) $r = 4\sqrt{p^2 + q^2}$ (b) $r = \sqrt{4(p^2 + q)}$ (c) $r = \sqrt{p^2 + q}$ (d) $r = 4\sqrt{p^2 - q}$

Ans. ***(c)***

Sol. Diagonal $= \sqrt{l^2 + b^2 + h^2} = p$

TSA = 2(lb + bh + hl) = q

Sum of coinitial edges = l + b + h = r

$\Rightarrow$ $(l + b + h)^2 = l^2 + b^2 + h^2 + 2(lb + bh + hl)$

$\Rightarrow$ $r^2 = p^2 + q$

$\Rightarrow$ $r = \sqrt{p^2 + q}$

12. If a cube has surface area s and volume v, then the volume of the cube with surface area 2s will be

(a) 2v (b) $2\sqrt{2}v$ (c) 4v (d) $\sqrt{2}v$

Ans. ***(b)***

Sol. Surface area of cube, $s = 6a^2$

Volume of cube, $v = a^3$

New cube with surface area 2s

$\Rightarrow$ $6a_1^{\,2} = 12a^2$

$a_1 = \sqrt{2}a$

Volume $v_1 = (a_1)^3 = \left(\sqrt{2}a\right)^3 = 2\sqrt{2}a^3 = 2\sqrt{2}v$

13. Average of 1st 100 natural numbers is

(a) 50 (b) 50.5 (c) 505 (d) 51.5

Ans. ***(b)***

Sol. Average of first 100 natural numbers $= \frac{1+100}{2} = 50.5$

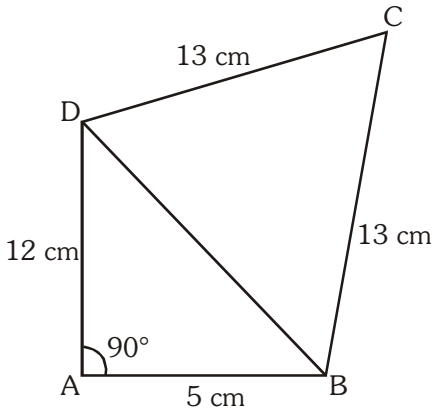
14. In the figure given below, ABCD is a quadrilateral and if $\overline{AB} = 5\text{cm}$, $\overline{AD} = 12\text{cm}$, $\overline{BC} = \overline{CD} = 13\text{cm}$, then the area of the quadrilateral ABCD is

(a) $\frac{1}{4}\left(120 + 169\sqrt{3}\right)$sq.cm

(b) $\frac{1}{4}\left(120 - 169\sqrt{3}\right)$sq.cm

(c) $\frac{1}{2}\left(60 + 169\sqrt{3}\right)$sq.cm

(d) $\frac{1}{2}\left(60 - 169\sqrt{3}\right)$sq.cm



Ans. ***(a)***

Sol. $BD = \sqrt{AB^2 + AD^2}$

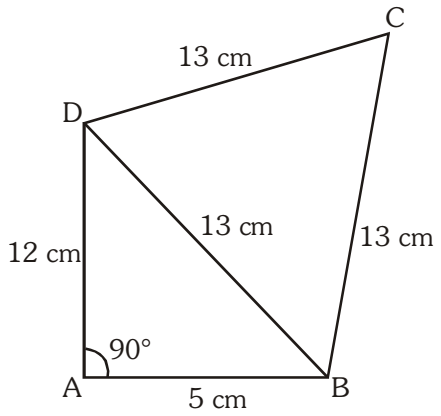
$= \sqrt{144 + 25}$

$= 13$ cm

Area of ABCD = Area of ΔABC + Area of ΔBCD

$= \frac{1}{2} \times 5 \times 12 + \frac{\sqrt{3}(13)^2}{4}$

$= \frac{1}{4}\left(120 + 169\sqrt{3}\right) cm^2$

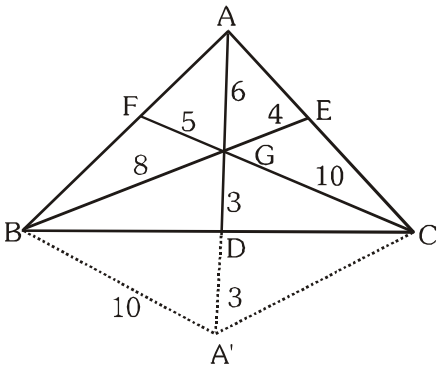


15. Area of a triangle whose lengths of medians are 9 cm, 12 cm and 15 cm will be

(a) 72 sq. cm (b) 36 sq. cm (c) 154 sq. cm (d) 108 sq. cm

Ans. ***(a)***

Sol.



Let AD = 9 cm

BE = 12 cm

CF = 15 cm

Now take a point A' exterior to Δ ABC

such that Δ BDA' $\cong$ Δ CDG

$\therefore$ BGA' becomes right Δ.

$\therefore$ Area of Δ BGD = $\frac{1}{2}$(area of Δ BGA') = 12 cm^2

$\therefore$ Area of Δ ABC = 6 × 12 = 72 cm^2

16. The relation which will be obtained by eliminating θ from $x = a\sec^n\theta$ and $y = b\tan^n\theta$ is

(a) $\left(\frac{x}{a}\right)^{1/n} + \left(\frac{y}{b}\right)^{1/n} = 1$ (b) $\left(\frac{x}{a}\right)^2 - \left(\frac{y}{b}\right)^2 = 1$

(c) $\left(\frac{x}{a}\right)^{1/n} - \left(\frac{y}{b}\right)^{1/n} = 1$ (d) $\left(\frac{x}{a}\right)^{2/n} - \left(\frac{y}{b}\right)^{2/n} = 1$

Ans. ***(d)***

Sol. $x = a\sec^n\theta,\ y = b\tan^n\theta$

$$\left(\frac{x}{a}\right)^{\frac{1}{n}} = \sec\theta\,;\ \left(\frac{y}{b}\right)^{\frac{1}{n}} = \tan\theta$$

$$\left(\frac{x}{a}\right)^{\frac{2}{n}} - \left(\frac{y}{b}\right)^{\frac{2}{n}} = \sec^2\theta - \tan^2\theta = 1$$

$$\Rightarrow \left(\frac{x}{a}\right)^{\frac{2}{n}} - \left(\frac{y}{b}\right)^{\frac{2}{n}} = 1$$

17. If ABCD is a cyclic quadrilateral, then the value of $\left(\tan\frac{A}{2}\tan\frac{C}{2} + \tan\frac{B}{2}\tan\frac{D}{2}\right)$ is

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

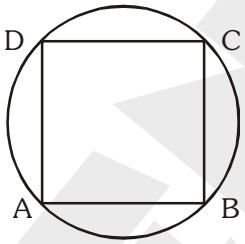
Ans. ***(d)***

Sol. $\tan\frac{A}{2}\tan\frac{C}{2} + \tan\frac{B}{2}\tan\frac{D}{2}$

$= \tan\frac{A}{2}\tan\left(90° - \frac{A}{2}\right) + \tan\frac{B}{2}\tan\left(90° - \frac{B}{2}\right)$

$= \tan\frac{A}{2}\cot\frac{A}{2} + \tan\frac{B}{2}\cot\frac{B}{2}$

$= 1 + 1 = 2$



18. 4 unbiased coins are tossed simultaneously. The probability that two tails occur will be

(a) $\frac{3}{8}$ (b) $\frac{3}{16}$ (c) $\frac{4}{16}$ (d) $\frac{5}{16}$

Ans. ***(a)***

Sol. Favourable outcomes (HHTT, HTTH, TTHH, THTH, HTHT, THHT) = 6

Total outcomes = $2^4 = 16$

$$\text{Probability} = \frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{6}{16} = \frac{3}{8}$$

19. The roots of the equation $x^2 - 5x - 2 = 0$ are

(a) Real and Rational (b) Imaginary (c) Real and Equal (d) Real and Irrational

Ans. ***(d)***

Sol. $x^2 - 5x - 2 = 0$

$D = 25 - 4 \times 1 \times (-2)$

$= 25 + 8$

$= 33 > 0$ (Roots are real)

$$x = \frac{5 \pm \sqrt{33}}{2}$$

$\therefore$ Roots are real and irrational.

20. If $\sum f_i x_i = 216$, $\sum f_i = 16$ and weighted mean = 13.5 + P, then the value of P will be

(a) 1 (b) 0.1 (c) 0.01 (d) 0

Ans. ***(d)***

Sol. Mean $= \frac{\sum F_i x_i}{\sum F_i} = \frac{216}{16} = 13.5 + P$

$\Rightarrow 13.5 = 13.5 + P$

$\Rightarrow P = 0$

21. The distance-time graph of a particle makes an angle 45° with the time axis. After 1 second it makes an angle 60° with the time axis. What is the average acceleration of the particle during this time interval?

(a) $(\sqrt{3}-1)$ unit (b) $(\sqrt{3}+1)$ unit (c) $\sqrt{3}$ unit (d) 1 unit

Ans. ***(a)***

Sol. Slope of s-t graph gives velocity

when $\theta = 45°$

slope = $\tan\theta$ = velocity (v_1)

$v_1 = \tan 45° = 1$ m/s

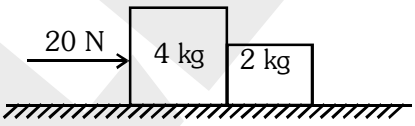
when $\theta = 60°$

slope = $\tan\theta$ = velocity (v_2)

$v_2 = \tan 60° = \sqrt{3}$ m/s

$$\vec{a}_{average} = \frac{\text{change in velocity}}{\text{time}} = \frac{v_2 - v_1}{t} = \frac{\sqrt{3}-1}{1} = \sqrt{3}-1 \text{ units}$$

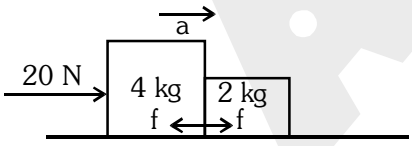
22. Two blocks of mass 4 kg and 2 kg are placed side by side on a smooth horizontal table and a horizontal force of 20 N is applied on the 4 kg block as shown in the figure. The normal reaction between the two blocks will be



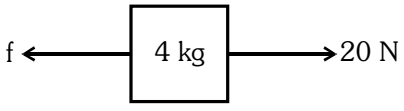
(a) 10/3 N (b) 20/3 N (c) 25/3 N (d) 40/3 N

Ans. ***(b)***

Sol.



F.B.D for 4 kg

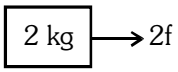


$f_{net} = 20 - f$

$ma = 20 - f$ (f = normal reaction)

$4a = 20 - f$ .....(1)

F.B.D for 2 kg



$f_{net} = f$

$ma = f$

$2a = f$ .....(2)

Adding both equations (1) and (2)

$4a + 2a = 20 - f + f$

$6a = 20$

$a = \frac{10}{3}$ m/s^2

putting the value of 'a' in equation (2)

$2 \times \frac{10}{3} = f$

$\boxed{f = \frac{20}{3} N}$

23. All other conditions remaining same, if the velocity of sound in oxygen and hydrogen gases are given by V_O and V_H respectively, then which one of the following is correct?

(a) $V_H = 2V_O$ (b) $V_H = 4V_O$ (c) $V_H = V_O$ (d) $V_O = 4V_H$

Ans. ***(b)***

Sol. $V \propto \frac{1}{\sqrt{M}}$

$V_O = \frac{1}{\sqrt{M_O}}$ (V_O = velocity of oxygen, M_O = molecular mass of oxygen)

$V_H = \frac{1}{\sqrt{M_H}}$

$\frac{V_H}{V_O} = \sqrt{\frac{M_O}{M_H}} = \sqrt{\frac{32}{2}} = 4$ (V_H = velocity of hydrogen, M_H = molecular mass of hydrogen)

$\frac{V_H}{V_O} = \frac{4}{1}$

$V_H = 4V_O$

24. All other conditions remaining same, if the temperature of a gas medium drops by 1%, the velocity of sound in that medium will

(a) increase by 0.5% remain unchanged (b) remain unchanged

(c) decrease by 0.5% (d) decrease by 2%

Ans. ***(c)***

Sol. $V \propto \sqrt{T}$ (T = Temperature)

$$\frac{\Delta V}{V} = \frac{1}{2}\frac{\Delta T}{T}$$

$$\frac{\Delta T}{T} = 1\%$$

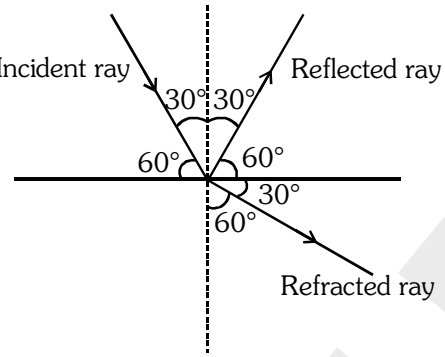
$$\frac{\Delta V}{V} = \frac{1}{2} \times 1\% = 0.5\ \%$$ (decreases)

25. A beam of light is incident at 60° to a plane separating two medium. The reflected and refracted rays are found to be perpendiclar to each other. What is the refractive index of the second medium with respect to the first medium?

(a) $1/\sqrt{3}$ (b) 1/3 (c) $\sqrt{3}$ (d) 3

Ans. ***(a)***

Sol.



$$n_{21} = \frac{\sin i}{\sin r} = \frac{\sin 30°}{\sin 60°} = \frac{1/2}{\sqrt{3}/2} = \frac{1}{\sqrt{3}}$$

26. The peak value of AC voltage on a 220 V mains is

(a) $240\sqrt{2}$V (b) $230\sqrt{2}$V (c) $220\sqrt{2}$V (d) $110\sqrt{2}$V

Ans. ***(c)***

Sol. $\sqrt{2} \times 220$ V

27. Two rain drops reach the earth with terminal velocities in the ratio 4 : 9. What is the ratio of their radii? (Take all other conditions remains same)

(a) 4 : 9 (b) 2 : 3 (c) 16 : 81 (d) 9 : 4

Ans. ***(b)***

Sol. Ratio of terminal velocities = 4 : 9

Let their radii be r_1 and r_2 respectively.

$$\frac{\frac{2gr_1^2(T-\sigma)}{9\eta}}{\frac{2gr_2^2(T-\sigma)}{9\eta}} = \frac{4}{9}$$

$$\frac{r_1^2}{r_2^2} = \frac{4}{9} = \frac{2}{3}$$

28. The absolute refractive indices of water and glass are 4/3 and 3/2 respectively. Which is the refractive index of glass with respect to water?

(a) 1.125 (b) 1.5 (c) 1.25 (d) 1.52

Ans. ***(a)***

Sol. $n_w = \frac{4}{3}$; $n_g = \frac{3}{2}$

$$n_{gw} = \frac{n_g}{n_w} = \frac{3/2}{4/3} = \frac{9}{8} = 1.125$$

29. A block of ice is floating in water keeping $1/11^{th}$ part of its volume above water level. Taking density of water as 1 g/cm^3, what is the nearest value of density of ice block?

(a) 0.81 g/cm^3 (b) 0.91 g/cm^3 (c) 0.11 g/cm^3 (d) 1.11 g/cm^3

Ans. ***(b)***

Sol. $\frac{V_L}{V_S} = \frac{\rho_S}{\rho_L}$

Volume of ice inside water = $\frac{10}{11}$

$$\frac{10}{11} = \frac{\rho_S}{\rho_L}$$

$\rho_S = 0.909 \times 1 = 0.909$ g/cm^3

30. A and B are two radioactive substances having half life periods T_A and T_B respectively. If $T_A = 3T_B$ and λ_A and λ_B are the respective disintegration constant, what relation between them is correct?

(a) $\lambda_B : \lambda_A = 3 : 1$ (b) $\lambda_B : \lambda_A = 1 : 3$ (c) $\lambda_B : \lambda_A = 2 : 3$ (d) $\lambda_B : \lambda_A = 3 : 2$

Ans. ***(a)***

Sol. $T_A = \frac{0.693}{\lambda_A}$; $T_B = \frac{0.693}{\lambda_B}$

$$\frac{T_A}{T_B} = \frac{\frac{0.693}{\lambda_A}}{\frac{0.693}{\lambda_B}} = \frac{\lambda_B}{\lambda_A}$$

$$\frac{3T_B}{T_B} = \frac{\lambda_B}{\lambda_A}$$

$\lambda_B = \lambda_A = 3 : 1$

31. In the equation of motion $S = at^2 + bt$; S and t are distance and time respectively and a and b are constants. The unit of a and b are respectively given by

(a) m/s^2, m/s (b) m/s^2, m/s^2 (c) m/s^2, m/s^3 (d) m/s, m/s^2

Ans. ***(a)***

Sol. $s = at^2 + bt$

since $s = ut + \frac{1}{2}at^2$

$a = m/s^2$

$b = m/s$

32. When electromagnetic wave propagates, the angle between the electric field and the magnetic field is given by

(a) 0° (b) 90° (c) 45° (d) 135°

Ans. ***(b)***

Sol. The angle between electric field and magnetic field is 90°

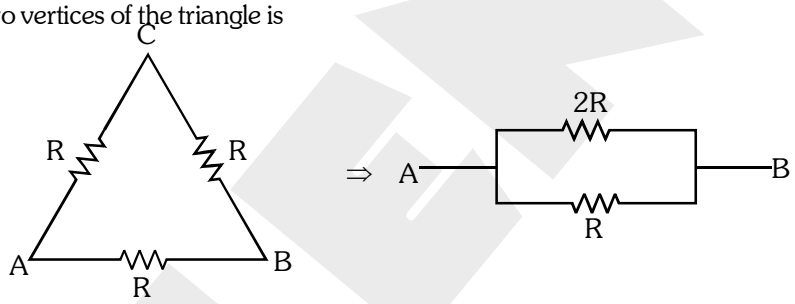
33. The three sides of triangle are of equal resistance of value R each. What is the equivalent resistance between any two vertexes of triangle?

(a) 3R (b) 2R (c) R/3 (d) 2R/3

Ans. ***(d)***

Sol. Resistance between any two vertices of the triangle is

$R + R = 2R$



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

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

$$R = \frac{2R}{3}$$

34. Number of neutrons in a parent nucleus 'A' which gives ${}_7N^{14}$ after two successive beta emission would be

(a) 6 (b) 7 (c) 8 (d) 9

Ans. ***(d)***

Sol. ${}_XA^Y \xrightarrow{\beta \text{ emission}} {}_{X+1}B^Y \xrightarrow{\beta \text{ emission}} {}_7N^{14}$

$(\beta = {}_{-1}e^0)$ $X+2 = 7$

$X = 5$

${}_5A^{14}$ = number of neutrons = $14 - 5 = 9$

35. The anhydride of pyrosulphuric acid is

(a) SO_2 (b) SO_3 (c) S_2O_3 (d) S_2O_7

Ans. ***(b)***

Sol. $H_2SO_4 + SO_3 \rightarrow H_2S_2O_7$

$H_2O + SO_3 + SO_3 \rightarrow H_2S_2O_7$

36. Which ammonium compound does not produce ammonia gas on heating

(a) $(NH_4)_2SO_4$ (b) $(NH_4)_2CO_3$ (c) NH_4NO_2 (d) NH_4Cl

Ans. ***(c)***

Sol. $NH_4NO_2 \rightarrow N_2 + 2H_2O$

37. The compound which contains ionic as well as covalent bond is

(a) H_2O_2 (b) KCN (c) KCl (d) CH_3Cl

Ans. ***(b)***

Sol. KCN contains K^+ ion and CN^- ion which forms ionic bond whereas in CN^- ion contains covalent bond

38. In the following compounds which two are not isomers to each other

(a) $(CH_3)_2CHCH_3$, $(CH_3)_2CHCH_2CH_3$

(b) CH_3CH_2OH, CH_3-O-CH_3

(c) C_2H_5-O-C_2H_5, CH_3-O-C_3H_7

(d) CH_3CH_2CHO, CH_3COCH_3

Ans. ***(a)***

Sol. Isomers are the compound which have same molecular formula but different structural formula in option a molecular formula of both compound is different. C_4H_{10}, C_5H_{12}

39. The reaction of $AgNO_3$ with acetylene shows which type of property of acetylene

(a) Acidic (b) Oxidizing (c) Basic (d) Reducing

Ans. ***(a)***

Sol. $C_2H_2 + 2AgNO_3 \rightarrow Ag_2C_2 + 2HNO_3$ In this reaction acetylene shows acidic property.

40. In the titration of a weak acid and weak base no indicator is suitable for locating the end point. This is due to

(a) indicator not changing its colour (b) pH change being much less at the equivalence point

(c) neutralization reaction is very slow (d) neutralization reaction is very fast

Ans. ***(b)***

Sol. A solution of a weak acid cannot be titrated with a weak base using an indicator to find the end point because the pH change is too gradual close to the equivalence point.

41. What is the number of molecules of CO_2 which contains 8 gms of O_2?

(a) 1.5×10^{23} molecules (b) 2×10^{23} molecules (c) 1.5×10^{22} molecules (d) 2×10^{22} molecules

Ans. ***(a)***

Sol. N_A molecules of CO_2 contains 32 g of O_2

$(N_A \times 8)/32$ molecules contains 8 g of O_2

$\frac{1}{4} \times 6.023 \times 10^{23}$ gives 1.5×10^{23} molecules.

42. Which reagent will be helpful in differentiating ethanoic acid from ethanol?

(a) Br_2/CCl_4 (b) Dilute NaOH (c) Dilute HCl solution (d) $NaHCO_3$

Ans. ***(d)***

Sol. $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

$C_2H_5OH + NaHCO_3 \rightarrow$ No reaction

43. Which statement about the cathode and anode of an electrolytic cell is correctly applicable?

(a) Oxidation occurs at cathode and cathode is a negative electrode.

(b) Reduction occurs at cathode and anode is a negative electrode.

(c) Oxidation occurs at anode and anode is a Positive electrode.

(d)Reduction occurs at anode and cathode is a positive electrode.

Ans. ***(c)***

Sol. In electrolytic cell oxidation occurs at anode and reduction occurs at cathode. Anode is a positive terminal.

44. A sample of aqueous $CuSO_4$ was divided in to two equal parts. Through one of these H_2S gas was passed and through the other a small amount of dilute NH_3 solution was added. The colour of the precipitates formed in these two cases will be respectively

(a) Black and brown (b) Bluish- white and black (c) Brown and black (d) Black and bluish-white

Ans. ***(d)***

Sol. $CuSO_4 + H_2S \rightarrow \underset{\text{Black ppt.}}{CuS\downarrow} + H_2SO_4$

$CuSO_4 + 2NH_3 \rightarrow \underset{\text{Bluish -white}}{[Cu(NH_3)_2]SO_4}$

45. Among the four elements Li, Na, K, Be, which one has the highest first ionisation energy?

(a) Li (b) Be (c) K (d) Na

Ans. ***(b)***

Sol. Be belongs to group II which has more ionisation energy than group I elements.

46. Under the identical conditions of temperature, The density of gas A is three times that of gas B while molecular mass of B is twice that of gas A. The ratio of pressures of A and B will be

(a) 6:1 (b) 1:6 (c) 2:3 (d) 3:2

Ans. ***(a)***

Sol. $d_A = 3d_B$

$M_B = 2M_A$

$$d_A = \frac{P_A M_A}{RT} \quad d_B = \frac{P_B M_B}{RT}$$

$$\frac{d_A}{d_B} = \frac{P_A M_A}{P_B M_B}, \quad \frac{3d_B}{d_B} = \frac{P_A M_A}{P_B 2M_A},$$

$$\frac{P_A}{P_B} = \frac{6}{1}$$

47. ACTH stimulates production of

(a) Glucocorticoids (b) Adrenaline (c) Thyroxine (d) Gonadotropins

Ans. ***(a)***

Sol. ACTH(Adreno cortico tropic hormone)is secreted by pituitary gland which stimulates the production of glucocorticoids from adrenal cortex.

48. The enzyme,secreted in your mouth helps to digest the rice that you are having in your lunch is

(a) Salivary amylase (b) Pepsin (c) Trypsin (d) Intestinal lipase

Ans. ***(a)***

Sol. The enzyme secreted by salivary gland is salivary amylase which helps in digestion of starch ,as rice also contains starch so it will be digested by salivary amylase.

49. Mendel chose the following plant for his experiment related to heredity:

(a) *Pisum sativum*(matar) (b) *Hibiscus rosasinensis*(Jaba) (c) *Mirabilis jalapa*(Sandhyamalati)(d) None of the above

Ans. ***(a)***

Sol. Mendel chose *Pisum Sativum*(matar)for his experiment.

50. The membrane enclosing the heart is known as

(a) Epicardium (b) Pericardium (c) Supracardium (d) Endocardium

Ans. ***(b)***

Sol. The membrane enclosing the heart is pericardium.

51. Analogous organs are those which have

(a) Common origin and common functions (b) Common origin but different functions.

(c) Similar functions but different origins (d) Different functions and different origins.

Ans. ***(c)***

Sol. Analogous organs are those which have similar functions but different origin.e.g.insect wing,bird wing,bat wing. Mentioned examples perform similar function but are different in origin.

52. Plants that have pneumatophores and show vivipary are known as

(a) Mesophytes (b) Halophytes (c) Psammophytes (d) Hydrophytes

Ans. ***(b)***

Sol. Halophytes have pneumatophores and show vivipary also.These are the adaptations for saline environment.

53. Passive immunity is obtained through injecting

(a) Antibiotics (b) Vaccines (c) Antigens (d) Antibodies

Ans. ***(d)***

Sol. Passive immunity is obtained through injecting antibodies.

54. A transition area between two biomes is known as

(a) Ecozone (b) Biotope (c) Ecotone (d) Buffer Zone

Ans. ***(c)***

Sol. An ecotone is a transition area between two biomes.It is where two communities meet and integrate.

55. Identify the wrong one

(a) Mollusca – Pseudopodia (b) Cnidaria - Nematocyst

(c) Annelida – True coelome (d) Echinodermata – Water vascular system

Ans. ***(a)***

Sol. Mollusca do not have pseudopodia.They have muscular foot for locomotion.

56. Air sacs in birds help in

(a) Double respiration (b) Increase of body weight (c) Storage of more food (d) loss in lung functions

Ans. ***(a)***

Sol. Air sacs in birds help in double respiration.Air sacs are found as tiny sacs as extension of lungs in birds.

57. Vasopressin is synthesized in

(a) Adenohypophysis (b) Thyroid (c) Hypothalamus (d) Neurohypophysis

Ans. ***(c)***

Sol. Vasopressin is synthesized in hypothalamus and stored in neurohypophysis also known as posterior pituitary.

58. The Acharya Jagadish Candra Bose Indian Botanic Garden is situated in

(a) Shibpur, Howrah (near Kolkata) (b) Dehradun

(c) Lucknow (d) Chennai

Ans. ***(a)***

Sol. The Acharya Jagdish Chandra Bose Indian Botanical Garden is situated in Shibpur,Howrah(near Kolkata).

59. Chromosomes are made up of

(a) DNA (b) RNA (c) Protein (d) All of the above

Ans. ***(d)***

Sol. Chromosomes are made up of DNA,RNA and Proteins.

60. The symbol of WWF (world wildlife found) is

(a) Giant Panda (b) Tiger (c) Rhododendron (d) White Bear

Ans. ***(a)***

Sol. The symbol of WWF (World Wildlife Fund) is Giant panda.

61. "I am the Revolution and I destroyed the Revolution" - Whose speech it was?

(a) Louis XIV (b) Alexander II (c) Napoleon Bonaparte (d) Bismarck

Ans. ***(c)***

Sol. As the year 1800 began, Napoleon Bonaparte, now 30 years old, was the most powerful man in France. "The Revolution is over," Bonaparte told the French people. "I am the Revolution."

62. Which of the following countries, mentioned was not the member of the Axis power in the Fist World War?

(a) Germany (b) Austria (c) Italy (d) Turkey

Ans. ***(c)***

Sol. Axis powers term was used in the II world war for the alliance of Germany, Italy and Japan. In I world war the alliance headed by Germany was termed as Triple Alliance and included Austria and Turkey.

63. The Russian Revolution took place in

(a) 1789 AD (b) 1857 AD (c) 1911 AD (d) 1917 AD

Ans. ***(d)***

Sol. Russian revolution took place in 1917 A.D.

64. The First Secretary General of the UNO was

(a) Trygve Lie (b) Ban kin Moon (c) Hammer Shield (d) Butros Butros Ghali

Ans. ***(a)***

Sol. Trygve Lie was the first Secretary General of UN

65. Sui Munda was the leader of

(a) The Munda Rebellion (b) The Kol Rebellion

(c) The Chuarh Rebellion (d) The Santhal Rebellion

Ans. ***(b)***

Sol. In 1831 the Kols rebelled again. In that part of Chotanagpur area the 'Ijara' was given to Hindu, Muslim, Sikh Mahajan. They exceeded the limit of oppression. In protection of the oppression Buddhu Bhagat, Joya Bhagat, Jhindrai Manaki and Sui Munda amassed the Kols.

66. The editor of the 'Bengal Gazette' was

(a) Marshman (b) Surendranath Bandyopadhyay

(c) James Augustus Hickey (d) William Carrey

Ans. ***(c)***

Sol. James Augustus Hickey edited the Bengal Gazette

67. The First woman graduate of Calcutta University was

(a) Kadambini Ganguly (b) Sarala Devi Chaudhurani

(c) Swarna Kumari Devi (d) Kalpana Dutta

Ans. ***(a)***

Sol. The First Women Graduate of Calcutta University was Kadambini Ganguly

68. Mr. Allan Octavian Hume, who was the founder of the Indian National Congress was a

(a) Journalist (b) Civil Servant (c) Politicians (d) Police

Ans. ***(b)***

Sol. A.O.Hume was a retired Civil Servant

69. The first president of "All India Trade Union Congress" was

(a) Byomkesh Chakraborty (b) Surendranath Halder

(c) Lala Lajpat Rai (d) Qutubuddin Ahmed

Ans. ***(c)***

Sol. Lala Lajpat Rai was the First President of All India Trade Union Congress

70. 'Vaikom Satyagraha' was started in

(a) Kerala (b) Andhra Pradesh (c) Maharashtra (d) Gujarat

Ans. ***(a)***

Sol. Vaikom Satyagraha was started in Kerala

71. The Poona Pact (1932) was signed between

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

(c) Gandhiji and Chamberlin (d) Gandhiji and Ramsay Macdonald

Ans. ***(b)***

Sol. Poona Pact (1932) was signed between Gandhiji and Dr. B.R. Ambedkar

72. The writer of the book named 'Udbastu' was

(a) Hiranmoy Bandyopadhayay (b) Prafulla Kumar Chakraborty

(c) Prabhash Chandra Lahiri (d) Dakshinaranjan Basu

Ans. ***(a)***

Sol. Writer of the book named 'Udbastu' was Hiranmoy Bandyopadhayay

73. We separate our planet as two hemispheres - East and West. If you want to put your two legs in two hemisphere, then you must visit following counhtry

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

Ans. ***(d)***

Sol. Of the given options, only France is the country from which the Green Wich Meridian passes. So if you want to put your two legs in two hemispheres, then you must visit France

74. Limestone is an example of

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

Ans. ***(b)***

Sol. Limestone is an example of Sedimentary rock

75. If the location of Kolkata is 22°30' North and 88°30' East, what will be the latitude and longitude of the Antipode of Kolkata?

(a) 22°30' South and 88°30' West (b) 22°30' South and 91°30' West

(c) 58°30' South and 88°30' West (d) 31°30' South and 108°30' West

Ans. ***(a)***

Sol. Antipode if Kolkatta located at 22°30' North and 88°30' East is 22°30'South and 88°30' West

76. The processes of waste management involve

(a) Reuse of waste (b) Recycling of waste (c) Reduction of waste (d) All of these

Ans. ***(d)***

Sol. The processes of waste management involve - Reuse of waste, Recycling of waste & Reduction of waste

77. One depositional feature of the Glacier is

(a) Roche Mountonnes (b) Cravasse (c) Fonts (d) Drumlins

Ans. ***(d)***

Sol. Drumlin is one of the depositional feature of the Glacier

78. Which of the following is not suitable for the character of an 'Isobar'?

(a) The unit of isobar is millibar

(b) When the isobars are very near to each other, the wind blows faster

(c) When the isobars are not very close to each other, the movement of wind is slower

(d) Someimes the isobars are perpendicular to each other

Ans. ***(d)***

Sol. Isobars can not be Perpendicular to each other

79. Canary current flows along the coast of

(a) Portugal (b) Peru (c) Japan (d) India

Ans. ***(a)***

Sol. The Portugal Current, which lies off the Iberian west coast, is actually part of the Canary Current.

80. Which of the following is not a right bank tributary of the Ganga river?

(a) Yamuna (b) Son (c) Damodar (d) Gomti

Ans. ***(d)***

Sol. Gomti is a left bank tributary of the Ganga River

81. Crops grown during April, May and June are known as

(a) Zayad crops (b) Kharif crops (c) Rabi crops (d) Spring crops

Ans. ***(a)***

Sol. Zayad crops are the crops grown during April, May and June

82. Lamba in Gujarat is famous for

(a) Hydel power (b) Wind power (c) Atomic power (d) Thermal power

Ans. (b)

Sol. Lamba in Gujarat is famous for Wind Power

83. India's first petro-chemical industry is

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

Ans. (d)

Sol. NOCIL was incorporated in the year 1961 as National Organic Chemical Industries Ltd

84. Diamond Quadrilateral is related to

(a) Metro Rail (b) High Speed Railways (c) Road ways (d) Water ways

Ans. (b)

Sol. The Diamond Quadrilateral is a project of the Indian railways to establish a high speed rail network in India. The Diamond Quadrilateral will connect the four mega cities in India, Delhi, Mumbai, Kolkata and Chennai, similar to the Golden Quadrilateral expressway system.

85. 'The Prince' was written by

(a) Plato (b) Aristotole (c) Laski (d) Machiavelli

Ans. (d)

Sol. 'The Prince' is a 16th-century political treatise by the Italian diplomat and political theorist Niccolò Machiavelli.

86. 'Fundamental Duties' of the citizen of India are described in the constitution of India under chapter

(a) III (b) IV (c) V (d) VI

Ans. (b)

Sol. The fundamental duties were incorporated in Part IV-A of our constitution by 42nd Constitutional Amendment Act, 1976.

87. How many members of the Rajya Sabha can be nominated by the president of India?

(a) 2 (b) 4 (c) 6 (d) 12

Ans. (d)

Sol. Membership is limited to 250 members, and the present Rajya Sabha has 245 members. 233 members are elected by the Vidhan Sabha members and 12 are nominated by the President for their contributions to art, literature, science, and social services.

88. The President of India can Proclaim 'National Emergency' according to Article _____.

(a) 350 (b) 352 (c) 356 (d) 360

Ans. (b)

Sol. Article 352 of the Indian Constitution talks about the national emergency. National emergency is imposed whereby there is a grave threat to the security of India or any of its territory due to war, external aggression or armed rebellion.

89. The 'Joint Session' of the Parliament in India is presided over by the _____.

(a) Vice President (b) Speaker of the Lok Sabha (c) Governor (d) President

Ans. (b)

Sol. The joint sitting of the Parliament is called by the President (Article 108) and is presided over by the Speaker or, in his absence, by the Deputy Speaker of the Lok Sabha or in his absence, the Deputy-Chairman of the Rajya Sabha.

90. In Parliamentary System of the Cabinet remains responsible to the ____.

(a) President (b) Prime Minister (c) Legislature (d) Supreme Court

Ans. ***(c)***

Sol. In Parliamentary System of the Cabinet remains responsible to the Legislature

91. The term of the non permanent members of the Security Council of the U.N.O. is ____.

(a) 2 years (b) 3 years (c) 4 years (d) 5 years

Ans. ***(a)***

Sol. The term of the non-permanent members of the Security Council of the U.N.O is 2 years

92. The Upper House of the State Legislature is _____.

(a) Legislative Assembly (b) Legislative Council (c) Lok Sabha (d) Rajya Sabha

Ans. ***(b)***

Sol. The Upper House of the State Legislature is Legislative Council.

93. National Income of a country is the total of

(a) All the incomes of the persons of a country (b) the income generated by the public sector

(c) the factor incomes (d) (b) and the total of all income from abroad.

Ans. ***(a)***

Sol. National Income of a country is the total of the all the income of the persons of a country.

94. Which of the following taxes is not useful to lower the inequality in income?

(a) Goods and Service Tax (b) Income Tax

(c) Wealth Tax (d) Profession Tax

Ans. ***(a)***

Sol. Goods and Service Tax is not useful to lower the inequality in income.

95. In which form of market there is no control on price by an individual seller?

(a) A market where there is a large number of buyers and large number of sellers

(b) A market where there is a large number of buyers and a single seller

(c) A market where there is a single seller and a single buyer

(d) A market where there is few sellers and a large number of buyers

Ans. ***(a)***

Sol. In market where there is a large number of buyers and large number of sellers, there is no control on price by an individual seller.

96. Suppose, x denotes the rate of interest on the securities sold by Central Bank to Commercial Banks and y denotes the rate of interest on the loans take by Commercial Bank from Central Bank. Now to lower the capacity of Commercial Banks to provide loans which one is necessary in the time of inflation?

(a) y must be less than x (b) y must be greater than x

(c) x and y must be equal (d) It is not dependent on x and y

Ans. ***(b)***

Sol. To lower the capacity of Commercial Banks to provide loans y must be greater than x.

97. The earning of a factor of production from an alternative use is known as the ____ of that factor of production

(a) Money Cost (b) Real Cost (c) Average Cost (d) Opportunity Cost

Ans. ***(d)***

Sol. The earning of a factor of production from an alternative use is known as the Opportunity Cost of that factor of production.

98. If the price elasticity of demand for a goods is inelastic and there is no substitute goods in the market, an increase in its price will cause that total expenditure of consumers of the goods to

(a) Increase (b) decrease (c) remain same (d) become zero

Ans. ***(a)***

Sol. If the price elasticity of demand for goods is inelastic and there is no substitute goods in the market an increase in its price will cause the total expenditure of consumers of the goods to increase.

99. Which one of the following is not a characteristic of a Capitalist Economy?

(a) Private Ownership of resources (b) Freedom of enterprise

(c) Consumer sovereignty (d) Existence of Central Planning Authority

Ans. ***(d)***

Sol. Existence of Central Planning Authority is not a characteristic of a Capitalist Economy.

100. Human Development Index measures ____ of an economy.

(a) Birth rate (b) Death rate (c) Quality of education (d) Quality of life

Ans. ***(d)***

Sol. Human Development Index measures Quality of life.