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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 12 (PCM)
Question Paper Code : UN499

KEY

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EXPLANATIONS

MATHEMATICS

01. (A) On to but not one-one

02. (B) $|A| = \dfrac{1}{(a+ib)(a-ib)-(c+id)(-c+id)}$

$= \dfrac{1}{a^2+b^2+c^2+d^2} = 1$

$\therefore A^{-1} = \begin{bmatrix} a-ib & -c-id \\ c-id & a+ib \end{bmatrix}$

03. (D) $R_3 \to R_3 - R_2$; $R_2 \to R_2 - R_1$

$$\begin{vmatrix} x+2 & x+3 & x+5 \\ 2 & 3 & 4 \\ 4 & 5 & 6 \end{vmatrix} = -2$$

04. (C) By conceptual

05. (B) $(x_1, y_1, z_1) = (2, 1, 1)$;

$(x_2, y_2, z_2) = (6, -1, 2)$;

$(x_3, y_3, z_3) = (14, -5, p)$

$$\frac{x_1 - x_2}{x_2 - x_3} = \frac{z_1 - z_2}{z_2 - z_3} \Rightarrow p = 4$$

06. (A) $f(x)=\frac{x}{\sqrt{a^2+x^2}}-\frac{(d-x)}{\sqrt{b^2+(d-x)^2}}$

$=\frac{x}{\sqrt{a^2+x^2}}+\frac{(x-d)}{\sqrt{b^2+(x-d)^2}}$

$f'(x)=\frac{\sqrt{a^2+x^2}-\frac{x(2x)}{2\sqrt{a^2+x^2}}}{(a^2+x^2)}$

$+\frac{\sqrt{b^2+(x-d)^2}-\frac{(x-d)2(x-d)}{2\sqrt{b^2+(x-d)^2}}}{(b^2+(x-d)^2)}$

$=\frac{a^2+x^2-x^2}{(a^2+x^2)^{\frac{3}{2}}}+\frac{b^2+(x-d)^2-(x-d)^2}{(b^2+(x-d)^2)^{\frac{3}{2}}}$

$=\frac{a^2}{(a^2+x^2)^{\frac{3}{2}}}+\frac{b^2}{(b^2+(x-d)^2)^{\frac{3}{2}}}>0$

$\Rightarrow$ $f'(x) > 0, x \in R$

$\Rightarrow$ $f(x)$ is increasing function

Hence, $f(x)$ is increasing function

07. (C) Let $\tan^{-1}(2) = \alpha$ and $\cot^{-1}(3) = \beta$

$\tan\alpha = 2$; $\cot\beta = 3$

$\Rightarrow$ $\sec\alpha = \sqrt{5}$; $\text{coses}\,\beta = \sqrt{10}$

$\therefore \sec^2\alpha + \text{coses}^2\beta = 5 + 10 = 15$

08. (B) $-x_1 : x_2 = 3 : 2$

09. (C) $=\lim_{x\to 0}\frac{\sqrt{1+kx}-\sqrt{1-kx}}{x}$

$=\lim_{x\to 0}(2x^2+3x-2)$

$=\lim_{x\to 0}\frac{2k}{\sqrt{1+kx}+\sqrt{1-kx}}=-2$

$k=-2$

10. (A) $x^4 + y^4 = (x^2 + y^2)^2 - 2x^2y^2$

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

differentiating w.r.t. 'x'

$\therefore x^2(2y)\frac{dy}{dx}+2xy^2=0$

$\therefore \frac{dy}{dx}=\frac{-y}{x}$

$\therefore x^3y\frac{dy}{dx}=x^3y\times\frac{-y}{x}=-x^2y^2$

$= -1$

11. (B) $f'(x)=\begin{vmatrix}-2\sin x & 1 & 0\\ 1 & 2\cos x & 1\\ 0 & 1 & 2\cos x\end{vmatrix}$

$+\begin{vmatrix}2\cos x & 0 & 0\\ x-\frac{\pi}{2} & -2\sin x & 1\\ 0 & 0 & 2\cos x\end{vmatrix}$

$+\begin{vmatrix}2\cos x & 1 & 0\\ x-\frac{\pi}{2} & 2\cos x & 0\\ 0 & 1 & -2\sin x\end{vmatrix}$

$f'(\pi)=\begin{vmatrix}-2\sin\pi & 1 & 0\\ 1 & 2\cos\pi & 1\\ 0 & 1 & 2\cos\pi\end{vmatrix}$

$+\begin{vmatrix}2\cos\pi & 0 & 0\\ \pi-\frac{\pi}{2} & -2\sin\pi & 1\\ 0 & 0 & 2\cos\pi\end{vmatrix}$

$$+\begin{vmatrix} 2\cos\pi & 1 & 0 \\ \pi-\frac{\pi}{2} & 2\cos\pi & 0 \\ 0 & 1 & -2\sin\pi \end{vmatrix}$$

$$f'(\pi)=\begin{vmatrix} 0 & 1 & 0 \\ 1 & -2 & 1 \\ 0 & 1 & -2 \end{vmatrix}$$

$$+\begin{vmatrix} -2 & 0 & 0 \\ \frac{\pi}{2} & 0 & 1 \\ 0 & 0 & -2 \end{vmatrix}+\begin{vmatrix} -2 & 1 & 0 \\ \frac{\pi}{2} & -1 & 0 \\ 0 & 1 & 0 \end{vmatrix}$$

$$\begin{bmatrix} \therefore \sin\pi = 0 \\ \cos\pi = -1 \end{bmatrix}$$

$$f'(\pi) = -(-2+0) = 2$$

12. (A) $y = \sin x$ & $y = \cos x \Rightarrow x = 45°$

$m_1 = \cos 45° = \frac{1}{\sqrt{2}}$ & $m_2 = -\sin 45° = -\frac{1}{\sqrt{2}}$

$$\tan\theta = \left|\frac{m_1 - m_2}{1+m_1m_2}\right| \Rightarrow \tan\theta = \left|\frac{\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{2}}}{1-\frac{1}{2}}\right| = 2\sqrt{2}$$

$$\therefore \theta = \tan^{-1}\left(2\sqrt{2}\right)$$

13. (C) If A is the required even and S is the sample space then $n(S) = 6^3 = 216$

$n(A)$ = Coeff. of x^k in

$(x + x^2 + x^3 + x^4 + x^5 + x^6)^3$

= Coeff. of x^k in $\left[\frac{x\left(1-x^6\right)}{1-x}\right]^3$

= Coeff. of x^k in $x^3(1 - x^6)^3(1 - x)^{-3}$

= Coeff. of x^{k-3} in

$$\left(1-3x^6+3x^{12}-x^{18}\right)\left(1+{}^3C_1x+{}^4C_2x^2+....\right)$$

$9 \le k \le 14 \Rightarrow 6 \le k-3 \le 11$

$\Rightarrow n(A)$ = Coeff. of x^{k-3} is

$${}^{(k-1)}C_{k-3} - 3\,{}^{(k-7)}C_{k-9} = {}^{(k-1)}C_2 - 3\,{}^{(k-7)}C_2$$

$$= \frac{(k-1)(k-2)}{2} - \frac{3(k-7)(k-8)}{2}$$

$$= \frac{k^2-3k+2-3\left(k^2-15k+56\right)}{2}$$

$$= \frac{-2k^2+42k-166}{2}$$

$$= 21k - k^2 - 83$$

$$\therefore P(A) = \frac{n(A)}{n(S)} = \frac{21k-k^2-83}{216}$$

14. (C) Given $P(B) = \frac{3}{2}P(A)$ & $P(C) = \frac{1}{2}P(B)$

But $P(A) + P(B) + P(C) = 1$

$$P(A) + \frac{3}{2}P(A) + \frac{3}{4}P(A) = 1$$

$$\frac{13}{4}P(A) = 1$$

$$\therefore \quad P(A) = \frac{4}{13}, P(B) = \frac{6}{13} \& P(C) = \frac{3}{13}$$

$$P(A \cup C) = P(A) + P(C) = \frac{4}{13} + \frac{3}{13} = \frac{7}{13}$$

15. (C) We have $l = \frac{1}{\sqrt{2}}, m = -\frac{1}{2}$

As $l^2 + m^2 + n^2 = 1$

we have $n^2 = \frac{1}{4} \Rightarrow n = \frac{1}{2}$

We take positive values, so

$$n = \frac{1}{2} \Rightarrow \cos\theta = \frac{1}{2}$$

$$\therefore \theta = 60°$$

16. (B) $I = \int \frac{x^2-1}{(x+1)^2\sqrt{x(x^2+x+1)}}dx$

$$\frac{d}{dx}\left(\tan^{-1}\sqrt{\frac{x^2+x+1}{x}}\right)$$

$$= \frac{1}{1+\frac{x^2+x+1}{x}} \times \frac{d}{dx}\left(\sqrt{\frac{1+x+x^2}{x}}\right)$$

$$= \frac{x}{x^2+2x+1}\left[\frac{\sqrt{x}\times\frac{2x+1}{2\sqrt{x^2+x+1}} - \sqrt{x^2+x+1}\times\frac{1}{2\sqrt{x}}}{(\sqrt{x})^2}\right]$$

$$= \frac{\cancel{x}}{(x+1)^2}\left[\frac{\frac{\sqrt{x}(2x+1)}{2\sqrt{x^2+x+1}} - \frac{\sqrt{x^2+x+1}}{2\sqrt{x}}}{\cancel{x}}\right]$$

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

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

$$= \frac{1(x^2-1)}{2(x+1)^2\sqrt{x(x^2+x+1)}}$$

$$\therefore \frac{x^2-1}{(x+1)^2\sqrt{x(x^2+x+1)}}$$

$$2\frac{d}{dx}\left(\tan^{-1}\sqrt{\frac{x^2+x+1}{x}}\right)$$

$$\therefore I = \int \frac{d}{dx}\left(2\tan^{-1}\sqrt{\frac{x^2+x+1}{x}}\right)$$

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

$\therefore A = 2$

17. (D) $\int e^x\left(\frac{2+\sin 2x}{1+\cos 2x}\right)dx$

$$\int e^x(\tan x + \sec^2 x)dx = e^x \tan x + c$$

18. (A) $\underset{n\to\infty}{Lt}\left[\frac{1^4}{1^5+n^5}+\frac{2^4}{2^5+n^5}+.......+\frac{n^4}{n^5+n^5}\right]$

$$= \sum_{r=0}^{r=n}\left[\frac{r^4}{r^5+n^5}\right] = \int_0^1 \frac{x^4}{1+x^5}dx$$

put $1+x^5 = t \Rightarrow 5x^4 = \frac{dx}{dt} \Rightarrow x^4 = \frac{1}{5}\frac{dx}{dt}$

$$= \int_1^2 \frac{dt}{5t} = \frac{1}{5}[\log t]_1^2 = \frac{1}{5}\log 2$$

19. (B) $\int_2^3 \frac{dx}{x^2-x} = \int_2^3 \frac{dx}{x(x-1)}$

$$= \int_2^3\left(\frac{1}{x-1}-\frac{1}{x}\right)dx = \left[\log\left(\frac{x-1}{x}\right)\right]_{x=2}^3$$

$$\log\frac{2}{3} - \log\frac{1}{2} = \log\left(\frac{\frac{2}{3}}{\frac{1}{2}}\right) = \log\left(\frac{4}{3}\right)$$

20. (D) Reduce it in the form $\frac{dx}{dy} + Px = q$

$$\frac{dx}{dy} = \frac{1-x\sin y}{\cos y}$$

$$\Rightarrow \frac{dx}{dy} + x\tan y = \sec y$$

I.F = sec$y$

sol is x sec$y$ = $\int \sec y \sec y\, dy$

$x$sec$y$ = tan y + c

21. (C) Put $x + y + 1 = z \Rightarrow \frac{dy}{dx} = \frac{dz}{dx} - 1$

$(x + y + 1)\frac{dy}{dx} = 1 \Rightarrow z\left(\frac{dz}{dx} - 1\right) = 1$

$\Rightarrow \frac{dz}{dx} = 1 + \frac{1}{z} \Rightarrow \int \frac{z}{z+1} dz = \int dx$

$\Rightarrow z - \log(z + 1) = x + c$

$x + y + 1 = x + \log(x + y + 2) + c$

$y = \log(x + y + 2) + \log c \Rightarrow x + y + 2 = ce^{y}$

22. (A) Let $f(x) = \log\left\{e^{x}\left(\frac{x-2}{x+2}\right)^{\frac{3}{4}}\right\}$

$= \log e^{x} + \log\left(\frac{x-2}{x+2}\right)^{\frac{3}{4}}$

$= x\log e + \frac{3}{4}\log\left(\frac{x-2}{x+2}\right)$

$= x + \frac{3}{4}\log\left(\frac{x-2}{x+2}\right) \quad [\because \log e = 1]$

Now, $\frac{d}{dx}(f(x)) = 1 + \frac{3}{4}\frac{d}{dx}\log\left(\frac{x-2}{x+2}\right)$

$= 1 + \frac{3}{4}\left[\frac{x+2}{x-2}.\left\{\frac{(x+2).1-(x-2).1}{(x+2)^2}\right\}\right]$

$= 1 + \frac{3}{4} \times \frac{4}{x^2-4}$

$= 1 + \frac{3}{x^2-4}$

$\Rightarrow \frac{d}{dx}(f(x))\Big|_{\text{at } x=3} = 1 + \frac{3}{5} = \frac{8}{5}$

23. (C) Let $I = \int \frac{5x^2+3}{x^2\left(x^2-2\right)} dx$

Now, consider $\frac{5x^2+3}{x^2\left(x^2-2\right)}$ and take $x^2 = y$. Then,

$\frac{5x^2+3}{x^2\left(x^2-2\right)} = \frac{5y+3}{y(y-2)}$ ....(i)

Now, put $\frac{5y+3}{y(y-2)} = \frac{A}{y} + \frac{B}{y-2}$ ......(ii)

$\Rightarrow 5y + 3 = (y - 2)A + yB$

$\Rightarrow 5y + 3 = y(A + B) - 2A$

On comparing, we get

A + B = 5 and 3 = – 2A

$\Rightarrow A = \frac{-3}{2}$ and $B = \frac{13}{2}$

Thus, $\frac{5x^2+3}{x^2(x^2-2)} = -\frac{3}{2}\frac{1}{x^2} + \frac{13}{2}\frac{1}{x^2-2}$

Hence, $I = -\frac{3}{2}\int\frac{dx}{x^2} + \frac{13}{2}\int\frac{dx}{x^2-2}$

$= -\frac{3}{2}\left(-\frac{1}{x}\right) + \frac{13}{2} \times \frac{1}{2\sqrt{2}}\log\left|\frac{x-\sqrt{2}}{x+\sqrt{2}}\right| + C$

$= \frac{3}{2x} + \frac{13}{4\sqrt{2}}\log\left|\frac{x-\sqrt{2}}{x+\sqrt{2}}\right| + C$

24. (B) Given differential equation is

$(x - 4y^3)\frac{dy}{dx} - y = 0, (y > 0)$

$\Rightarrow (x - 4y^3)\frac{dy}{dx} = y$

$\Rightarrow \frac{x-4y^3}{y} = \frac{dx}{dy}$

$\Rightarrow \frac{dx}{dy} = \frac{x}{y} - 4y^2$

$\Rightarrow \frac{dx}{dy} - \frac{x}{y} = -4y^2$, which is a linear differential equations of the form

$$\frac{dx}{dy}+Px=Q$$

Now, I. F.

$$= e^{\int P dy} = e^{\int -\frac{1}{y} dy} = e^{-\log y} = e^{\log y^{-1}} = \frac{1}{y}$$

and is solution is given by

$$x.(\text{I. F.}) = \int (\text{I. F}).Q\, dy + C$$

$$\Rightarrow \frac{x}{y} = \int \frac{1}{y}\times\left(-4y^2\right)dy + C$$

$$\Rightarrow \frac{x}{y} = -4\frac{y^2}{2} + C$$

$$\Rightarrow x = -2y^3 + Cy$$

$$\Rightarrow x + 2y^3 = Cy$$

25. (C) $\lim_{x\to 0}\frac{\sqrt{1+kx}-\sqrt{1-kx}}{x} = \lim_{x\to 0}(2x^2+3x-2)$

$$\lim_{x\to 0}\frac{2k}{\sqrt{1+kx}+\sqrt{1-kx}} = -2$$

k = –2

PHYSICS

26. (D) Here I = 10 A; n = 9 × 10^{28} m^{-3}; A = 10^{-4} m^2

and e = 1.6 × 10^{-19} C

Now, $\upsilon_d = \frac{I}{neA} = \frac{10}{9\times10^{28}\times1.6\times10^{-19}\times10^{-4}}$

= 6.94 × 10^{-6} m s^{-1}

27. (B) As the magnet is moving under gravity, the flux linked with the copper tube will change because of the motion of the magnet. This will produce eddy current in the body of the copper tube. According to Lenz's law, these induced currents oppose the fall of the magnet thereby producing retarding force with continuously increases with increasing velocity till it becomes equal to the force of gravity. The net force on the magnet will become zero and it will almost move with constant speed.

28. (C) $F = q\,(\vec{V}\times\vec{B}) = (-e)(-v\hat{i}\times(-B\hat{K})) = evB\hat{j}$

Thus, force on the electron beam is along the + ve y-axis.

29. (B) For the equilibrium of the proton,

qE = mg

$$E = \frac{mg}{q}$$

$$= \frac{1.67\times10^{-27}\times9.8}{1.6\times10^{-19}} = 1.02\times10^{-7}\ NC^{-1}$$

30. (B) There is a time lag of about 10^{-10} s between the incidence of photon and photoelectron emission.

31. (B) B = 8 × 10^{-7} T, c = 3 × 10^8 m/s, E = ?

E = c × B = 3 × 10^8 × 8 × 10^{-7} = 240 V/m

32. (B) The value of neutral temperature is constant for a thermocouple. It depends on the nature of material and is independent of the temperature of the cold junction. The inversion temperature depends on the temperature of the cold junction as well as the nature of the material.

33. (C) The wavelength of de-Broglie wave associated with a moving particle is given by

$$\lambda = \frac{h}{p}$$

Therefore, if an electron and a photon possess the same wavelength, then they will possess the same momentum.

34. (A) The reactance of inductor, $X_L = \omega_L$

The reactance of a capacitor $X_c = \frac{1}{\omega C}$

where $\omega = 2\pi n$ & n is the frequency of AC source. Therefore, reactance of inductor increases.

35. (C) Actual value of dip $= \theta = ?$,

$$\tan\theta = \frac{B_v}{B_H} \quad ..(i)$$

The plane is inclined at 25° with the magnetic meridian. So the horizontal component is $B_H \cos 25°$. But the vertical component is the same. The angle of dip in this plane is 40°.

$$\tan 40° = \frac{B_v}{B_H \cos 25°} \quad ..(ii)$$

From equations (i) and (ii) we have,

$$\frac{\tan\theta}{\tan 40} = \cos 25$$

$\tan\theta = \tan 40 \times \cos 25 = 0.839 \times 0.91 = 0.7635$

$\theta = \tan^{-1}(0.7635) = 37.3°$

36. (B) Ray optics is valid, when characteristic dimensions are much larger than the wavelength of light.

It may be pointed out that wave optics is valid, when characterstic dimensions are of the order of the wavelength of light.

37. (B) Since $v\lambda = c, \frac{\Delta v}{v} = -\frac{\Delta\lambda}{\lambda}$ (for small changes in v and λ).

$\Delta\lambda = 589.6 - 589.0 = +0.6$ nm

Then, using Eq. (11.8), as given below, we get

$$\frac{\Delta v}{v} = -\frac{\Delta\lambda}{\lambda} - \upsilon_{radial} / c$$

$$\upsilon_{radial} \cong +c\left(\frac{0.6}{589.0}\right) = +3.06 \times 10^5 \, ms^{-1}$$

= 306 km/s.

Therefore, the galaxy is moving away from us.

38. (C) The heat developed in a system is proportional to the current through it.

It cannot be Joule heat. Joule heat produced in a system is proportional to the square of the current flowing through it i.e., $H_j \propto I^2$

39. (B) Statements 1 and 3 are correct.

An electron will accelerate when placed in an electric field.

Any charged object will experience a force in an electric field. When the electron experiences a force, it will accelerate is correct.

2. An electron will always move towards a positively-charged object in a straight line.

The field lines may not be straight. The electron will always flow along a field line is incorrect.

3. The direction of an electric field at any point is the direction of the force on a small positive charge placed at the point is correct.

This is the definition of the direction of an electric field.

40. (D) Let the potential be zero at the point P, at a distance x from the charge q_1.

$q_1 = -4\ \mu C = -4 \times 10^{-6}$ C, $q_2 = 2 \times 10^{-6}$ C

AP = x, PB = $(1 - x)$ m

Potential due to q_1 at P is $V_A = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1}{x}$

Potential due to q_2 at P is V_B

$$= \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_2}{(1-x)}$$

Total potential at P is zero

$$= \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_1}{x} + \frac{1}{4\pi\varepsilon_0} \cdot \frac{q_2}{(1-x)} = 0$$

$$\frac{q_1}{x} = -\frac{q_2}{(1-x)}$$

$$\frac{-4\times10^{-6}}{x} = \frac{-2\times10^{-6}}{1-x}$$

$2(1 - x) = x$

$2 - 2x = x$

$3x = 2$

$$x = \frac{2}{3} = 0.667\,m$$

The electric potential is zero at a point distance of 0.667 m from the – 4 μ C charge.

CHEMISTRY

41. (C) Greater conductance by HCl is due to greater mobility of H^+ ions.

42. (C) Both NF_3 and H_3O^+ have pyramidal structures whereas NO_3^- and BF_3 both have trigonal planar structures.

43. (A)

$$CH_3Cl \xrightarrow{KCN} CH_3CN \xrightarrow{H^+/H_2O} CH_3COOH$$

44. (B) 1 Mole of gold = 197 g = 6.02×10^{23} atoms

$$\therefore \quad 1\text{ g gold} = \frac{6.02\times10^{23}}{197}\text{ atoms}$$

As fcc contains 4 atoms per unit cell, therefore,

number of unit cells

$$= \frac{6.02\times10^{23}}{197\times4} = 7.64\times10^{20}$$

45. (D) The false statement about transition elements is that they show multiple oxidation states always differing by units of two. They differ by one unit.

46. (C) Aldehydes and ketones have lower boiling points than corresponding alcohols because they cannot form H-bonds with each other.

47. (D) In endothermic process of dissolution, energy factor opposes the dissolution. Less is the heat of dissolution, i.e., less is the opposing factor, greater is the solubility.

48. (D) As we move from top to bottom down the group, the ionization energy decreases and the electropositive character increases, therefore, the metallic character of the elements increases. Thus, Po the last element of oxygen family is a typical metal.

49. (B) $$-\frac{d[A]}{dt} = -\frac{1}{2}\frac{d[B]}{dt}$$

Hence $$-\frac{d[B]}{dt} = 2\times\frac{-d[A]}{dt}$$

$= 2 \times 2.6 \times 10^{-2}$ M sec^{-1}

$= 5.2 \times 10^{-2}$ M sec^{-1}

50. (B) Geometrical isomerism is shown by square planar and octahedral complexes.

51. (C) Ethyl chloride and acetyl chloride react with alc. KCN by nucleophilic substitution reaction while benzaldehyde undergoes benzoin condensation :

$$C_2H_5Cl \xrightarrow{KCN(alc.)} C_2H_5CN + KCl$$

$$CH_3COCl \xrightarrow{KCN(alc.)} CH_3COCN + KCl$$

$$2C_6H_5CHO \xrightarrow{KCN(alc.)} C_6H_5CHOHCOC_6H_5$$

Thus, only chlorobenzene does not react.

52. (C) Packing fractions are :

Cubic close packing $= \frac{\pi\sqrt{2}}{6} = 0.74 = 74\,\%$

Body centred cubic packing

$$= \frac{\pi\sqrt{3}}{8} = 0.68 = 68\,\%$$

Simple cubic $= \frac{\pi}{6} = 0.52 = 52\,\%$

Diamond $= \frac{\pi\sqrt{3}}{16} = 0.34 = 34\,\%$

53. (C) Halogens are coloured because their molecules absorb visible light causing the excitation of outer electrons to higher energy levels.

54. (A) Lucas reagent is conc. HCl + anhyd. $ZnCl_2$

55. (A) Colloidal solution of palladium has the smallest particle size and therefore largest surface area. Hence, it will have maximum adsorption.

CRITICAL THINKING

56. (D) 24

You should have eliminated choice "A" immediately. Indu can't be 14 years old if Meghana is going to be Indu's age in five years. The best way to eliminate other answer choices is to try plugging them in to the information given in the problem. For instance, for choice "B", if Indu is 10, then Meghana must be 5. The difference in their ages is 5. The difference between Eswar's age, 29, and Meghana's age, 5, is 24. Is 24 two times 5? No. Then choice "B" is wrong. If Indu = 19, then Meghana age = 14, Eshwar's age – Meghana's age

29 – 14 = 15

Indu's age – Meghana's age

19 – 14 = 5

15 is not two times of 5

You could eliminate choice "C" in the same way and be left with choice D.

If Indu's age = 24 then Meghana's age = 19

Indu's age – Meghana's age = 24 – 19 = 5

Eswar's age – meghana's age = 29 – 19 = 10

'5' is two times of 10

57. (B)

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Arun	✓	✓	✓	✓			
Dinesh	✓				✓	✓	✓

✓ Indicates the person telling the truth

If Arun tells the truth on that 'one day' that he lied 'yesterday', then that 'one day' must be Monday.

If Arun tells the lie on that 'one day' that he lied 'yesterday', then he must be telling the truth 'yesterday' and so that 'one day' must be Friday.

∴ based on Arun, it has to be either Monday or Friday.

Hence, that 'one day', when they both said that they lied 'yesterday', has to be Friday.

58. (C)

argument one is weak argument :

Explanation : Although the point is taken to be true, it does not provide evidence for the benefits of its position, it merely states an irrelevant fact, making this a weak argument.

argument two is weak argument :

Explanation : Accepting the argument as true, avoiding bankruptcy is an essential motive for an organisation, however, the statement does not discuss bankruptcy, rather it is discussing profits and expenses. Protection against bankruptcy is not the topic, and is straying from the point, and is, therefore a weak argument.

Argument three is strong argument :

Explanation : The argument addresses the initial statement directly, providing a clear disadvantage of the statement, making this a strong argument.

Argument four is weak argument :

Explanation : The initial question does not discuss taking away the company's right to control its own size, only aspect of it. Therefore, the point is arguing a separate question, rather than the initial one, presenting a weak argument.

59. (D) All actions given a right course of action following problem caused by the incessant rain for the past several days because each of the courses we provide relief to the victims.

60. (C)

Explanation:

On using all the conditions, we get the following table		
Name	**Soup**	**Ice Cream**
Avinash	Vegetable	Mango
Vijay	Tomato	Tutti-Fruti
Alok	Corn	Pista
Vivek	Chicken	Vanilla
Rajiv	Mutton	Cassata