Chemistry

1. C
1. Left to right electron gain enthalpy becomes more negative and top to bottom becomes less negative

2. C
2. The ionisation energy order is Li > Na > K > Rb > Cs so ease of formation of cation is : Li < Na < K < Rb < Cs.

3. A, B, D
3. The element X is sodium $|\Delta H_4| = |\Delta H_5|$ as $(\Delta Heg)_x = (\Delta H_{IE})_{x^-}$

   $\Delta H_3 > \Delta H_2 > \Delta H_1$ (successive IE is always higher than previous IE)

   $|\Delta H_1| = |\Delta H_6|$ as $(\Delta H_{IE})_x = (\Delta Heg)_{x^+}$

4. A, B, C, D
4. There is a huge difference between IE_3 and IE_4 so the most stable oxidation state +3.
   so it belongs to group 13. So it could be metal or non-metal and oxide of element may be amphoteric also.

5. A, C
5. $X = Na \quad S = NaCl$

   $Y = Mg \quad T = MgCl_2$

   $Z = Al \quad U = AlCl_3$

   $\underset{U}{AlCl_3} + NaOH \longrightarrow Al(OH)_3 + NaCl$

   $\underset{T}{MgCl_2} + NaOH \longrightarrow Mg(OH)_2 + NaCl$

   $\underset{S}{NaCl} + NaOH \longrightarrow No\ percipitate$

6. A, B, C, D
6. (A) $O^+ \rightarrow 1s^2\, 2s^2\, 2p^3 \quad C^+ \rightarrow 1s^2 2s^2 2p^1$

   $F^+ \rightarrow 1s^2\, 2s^2\, 2p^4 \quad IE_2 \rightarrow C < N < F < O$

   $N^+ \rightarrow 1s^2 2s^2 2p^2$

   (B) More is the charge on cation lesser in the size of cation

   $Al^{3+} < Mg^{2+} < Li^+ < K^+$

   (C) From left to right metallic character decreases and down the group metallic character increases.

   (D) $PbCl_2$ is more stable than $PbCl_4$ due to inert pair effect.

7. A, B, C

8. B
8. $NH_2 - NH_2 \longrightarrow$ Nitrogen containing compound X $+10e^-$

   Oxidation number of nitrogen

   $2x + 4 = 0$

   $2x = -4$

   $x = -2$

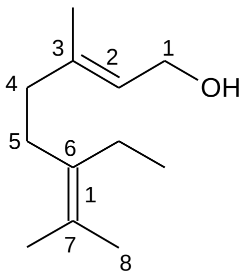
   The oxidation number of N in compound X should be +3. In one mole $NH_2 - NH_2$ two N atom are there so total $O.N$ number on $N = -4$

   And in X the total $O.N$ of N is 6. So change is of $10e^-$

9. A, B, C, D

10. C

10.



6-ethyl-3, 7-dimethyloct -2, 7–dien - 1-ol

1. A → p, q, s   B → p, r   C→ p, s   D→ p, r

1. (A) $(n-1)d^5\ ns^1\ \ n=6.\ 6^{th}$ period

Group number = Number of e$^-$ in ns and $(n-1)d$

$=6$

d has 5 e$^-$ so symmetrical distribution.

(B) $(n-1)d^1\ ns^2\ n=6,\ 6^{th}$ period

Group number = 3

(C) $ns^2np^3\ \ \ n=6,\ 6^{th}$ period

b has 3 electrons so symmetrical distribution of e$^-$

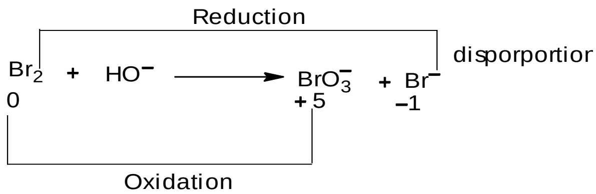
(D) $(n-2)f\,'(n-1)d^1\,ns^2\,n=6$

Group number = 3 $(f\ Block)$

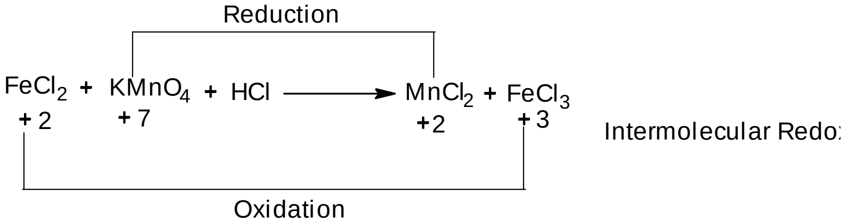
2. A → r   B → p   C→ q   D→ q, s

2.

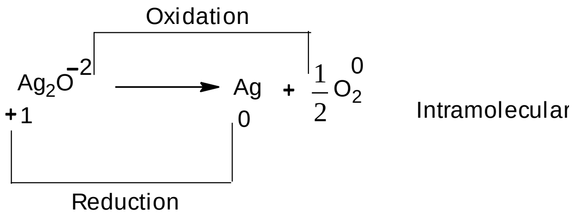
(A)



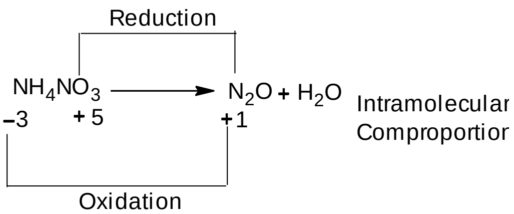
(B)



(C)



(D)



1. 7
1. Balanced redox reaction

$$28NO_3^- + 3As_2S_3 + 4H_2O \longrightarrow 6AsO_4^{3-} + 28NO + 9SO_4^{2-} + 8H^+$$

$x = 28$

$z = 4$

$\frac{x}{z} = 7$

2. 1
2. (i) , (ii), (v) and (vi) are true.
(iii), (iv) and (vii) are false.
So $x = 4$ and $y = 3$

$|x - y|^2 = |4 - 3|^2 = 1$

3. 7
3 Cs, Ba, F, Zn, Be, Al, Sr

4. 6
4. The oxy acid is $H - O - \ddot{\underset{\cdot\cdot}{Cl}} = O$

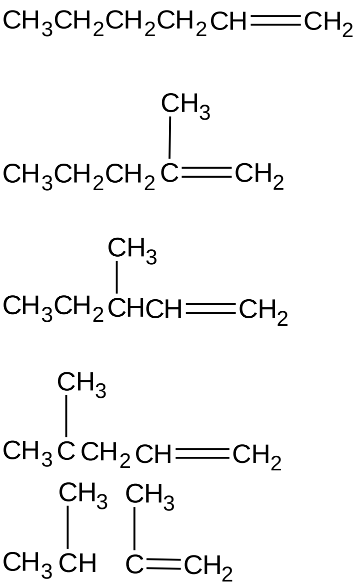
$x = 2$

$y = 2$

$z = 2$

$|x + y + z| = 6$

5. 6
6. 6
6.



7. 7

7. $n = 6$

$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 5p^6, 4d^{10}, 6s^2, 4f^{14}$

The number of unpaired electron in X are seven.

8. 6

MATHEMATICS

1. C

1. Probability of the event $= \frac{{}^{15}C_1 \times {}^{15}C_1}{{}^{30}C_2}$

$= \frac{15}{29}$

2. A, C

2. Radius of incircle is 1 unit.
area of shaded region
$=$ area of smaller circle + area of semicircle – area of triangle ACD

$= \pi + \frac{\pi}{2}\left(\frac{5}{2}\right)^2 - \frac{1}{2}\times 3\times 4$

$= \pi + \frac{25\pi}{8} - 6$

$= \frac{33\pi}{8} - 6$

$= \frac{33\pi}{8} - 6$

$= \frac{33\pi - 48}{8}$ sq. units.

3. A

3. C. S. A = $\pi r l = 154\sqrt{2}$

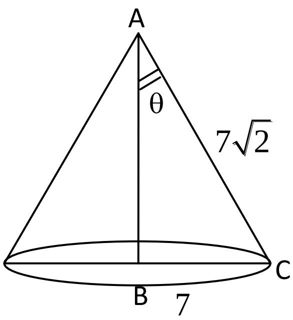
$l = \frac{154\sqrt{2}}{\pi r}$

$= 7\sqrt{2}$

$\sin\theta = \frac{7}{7\sqrt{2}}$

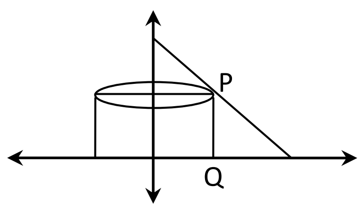
$\theta = 45°$

Vertical angle $= 2\theta = 90°$



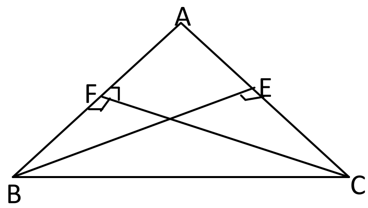
4. A

4. Radius of cylinder $= 4$
height $= k = 2$
Volume of the cylinder = $\pi 4^2 2.$
$= 32\pi$



5. A

5. In ΔBFC,



$BC^2 = BF^2 + CF^2$

$= BF^2 + AC^2 - AF^2 \quad ...(i)$

In ΔBEC,

$BC^2 = BE^2 + CE^2$

$= AB^2 - AE^2 + CE^2 \quad ...(2)$

adding (1) & (2)

$2BC^2 = BF^2 + AC^2 - AF^2 + AB^2 - AE^2 + CE^2$

$2BC^2 = BF^2 + AC^2 - (AB - BF)^2 + AB^2 - (AC - CE)^2 + CE^2$

$2BC^2 = BF^2 + AC^2 - AB^2 - BF^2 + 2AB.BF + AB^2 - AC^2 - CE^2$
$+2AC.CE + CE^2$

$= 2[AB.BF + AC.CE]$

6. C

6. $P(A) = 0.2 \quad P(B) = 0.5$

$P(A \cap B) = 0.15$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= 0.2 + 0.5 - 0.15$

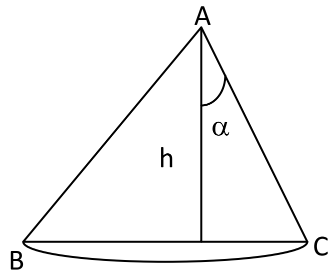
$= 0.7 - 0.15$

$= 0.55$

$P(\bar{A} \cap \bar{B}) = P(\overline{A \cup B}) = 1 - 0.55 = 0.45$

7. C, D

7. In ΔABC,



$\cot\alpha = \frac{h}{r}$

$h = r\cot\alpha$

Volume of cone $= \frac{1}{3}\pi r^2 r \cot\alpha$

8. C, D

8. $\sum_{r=1}^{n} \log \frac{a^r}{b^{r-1}}$

$= \log\frac{a}{1} + \log\frac{a^2}{b} + \log\frac{a^3}{b^2} + ... + \log\frac{a^n}{b^{n-1}}$

$= \log\frac{a.a^2a^3.....a^n}{b.b^2....b^{n-1}}$

$= \log\frac{a^{\frac{n(n+1)}{2}}}{b^{\frac{n(n-1)}{2}}}$

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

9. A, C

9. $(2-1)A = (2-1)(2+1)(2^2+1)(2^4+1)......(2^{2048}+1)$

$= (2^2-1)(2^2+1)(2^4+1).....(2^{2048}+1)$

$= (2^4-1)(2^4+1)......(2^{2048}+1)$

$A = 2^{4096}-1 \Rightarrow A+1 = 2^{4096} \Rightarrow (A+1)^{\frac{1}{2048}} = (2^{4096})^{\frac{1}{2048}} = 4$

10. D

10. $AD = 32\,cm$

$AF = 32-(24+r)$

In radius = $\dfrac{area}{semiperimeter}$

$= 12\,cm$

$\Delta AFE \sim \Delta ACD$

$\dfrac{AF}{AC} = \dfrac{FE}{DC}$

$\dfrac{32-(24+r)}{40} = \dfrac{r}{24}$

$8-r = \dfrac{5r}{3}$

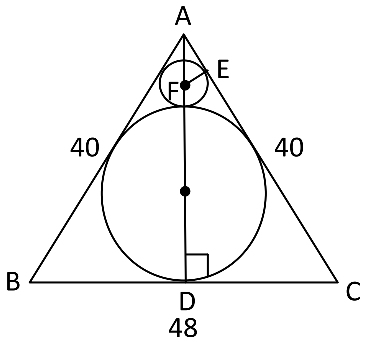
$\dfrac{8r}{3} = 8$

$r = 3cm$

area of smaller circle

$= \pi 3^2$

$= 9\pi cm^2$



1. A → p, s B → r C → p, s D → q, t

Sol. (A) $\sqrt[3]{\dfrac{8(1^3+2^3+3^3+...+n^3)}{27(1^3+2^3+3^3+....+n^3)}} = \dfrac{2}{3} = 0.\bar{6}$

(B) Probability of being aces card $= \dfrac{{}^4C_2}{{}^{52}C_2} = \dfrac{1}{221}$

(C) Probability that selected card is not divisible by 3

$=1-P$ (selected card is divisible by 3) $= 1-\dfrac{10}{30} = \dfrac{2}{3} = 0.\bar{6}$

(D) getting sum 3 or 6 or $12 = \{(1,2),(1,5),(2,1),(2,4),(3,3),(4,2),(5,1),(6,6)\}$

Probability $= \dfrac{8}{36} = \dfrac{2}{9} = 0.\bar{2}$

2. A → r B → p C → s D → q

2. (A) Slant height of pyramid

$$= \sqrt{5^2 + 15^2}$$
$$= 5\sqrt{10}\ cm$$

(B) Square of prime numbers

(C) $C = 2\pi r,\ A = \pi r^2$

$XC = 2\pi R,\ 2A = \pi R^2$

$$X = \frac{2\pi R}{C}$$
$$= \frac{2\pi R}{2\pi r}$$
$$= \frac{R}{r}$$
$$= \sqrt{2}$$

(D) Let roots be α and 2α

Sum $= 3\alpha = -(2a+1)$

$$\alpha = -\frac{(2a+1)}{3}$$

Product $= 2\alpha^2 = a^2 + 2$

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

$$\Rightarrow \quad \frac{4a^2+1+4a}{9} = \frac{a^2+2}{2}$$

$$\Rightarrow \quad 8a^2 + 2 + 8a = 9a^2 + 18$$
$$a^2 - 8a + 16 = 0$$
$$a = 4$$

1. 4

1. $h = \frac{2}{3}2r$

h $\rightarrow$ height

r $\rightarrow$ radius

Volume of cylinder = volume of sphere

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

$$r^2 . \frac{2}{3} . 2r = \frac{4}{3} . 4^3$$

$$r = 4$$

2. 4

2. Let coordinates of required point on y-axis be $A(0,-4)$ which is equidistant from P and Q.

$$(1-0)^2 + (4+4)^2 = (k-0)^2 + (3+4)^2$$
$$K = \pm 4$$

3. 8

3. $(5x-8y+11)\lambda + (8x-3y+4) = 0$

$$x(5\lambda+8) - y(8\lambda+3) + 11\lambda + 4 = 0$$

as the given line is parallel to x-axis

$$\Rightarrow 5\lambda + 8 = 0$$

$$-5\lambda = 8$$

1. 3

4 ΔDEF is also equilateral triangle let side of ΔABC be a.

In ΔACF, $\angle F = 60°$

$$\tan 60 = \frac{AC}{CF}$$

$$\sqrt{3} = \frac{a}{CF}$$

$$CF = \frac{a}{\sqrt{3}}$$

In ΔBCE

$$\angle E = 60$$

$$\sin 60° = \frac{BC}{CE}$$

$$\frac{\sqrt{3}}{2} = \frac{a}{CE}$$

$$CE = \frac{2a}{\sqrt{3}}$$

$$EF = CF + CE$$

$$= \frac{a}{\sqrt{3}} + \frac{2a}{\sqrt{3}} = \frac{3a}{\sqrt{3}} = \sqrt{3}a$$

$$\frac{area\ of\ \Delta DEF}{area\ of\ \Delta ABC} = \frac{\frac{\sqrt{3}}{4}.3a^2}{\frac{\sqrt{3}}{4}.a^2} = 3$$

5. 9

5. Let length and breadth be a and b

$$ab = 2(a+b)+9$$

$$ab - 2a - 2b = 9$$

$$a(b-2) - 2b + 4 = 13$$

$$a(b-2) - 2(b-2) = 13$$

$$(a-2)(b-2) = 13$$

$$a - 2 = 13 \qquad b - 2 = 1$$

$$a = 15, \qquad b = 3$$

Perimeter = $2(15+3) = 36$

6. 0

6. A, B, C, D lie on the circumference of a semicircle. $ABCD$ is a cyclic quadrilateral. Hence sum of opposite angle is $180°$

$$C = \pi - A, \quad D = \pi - B$$

$$\tan A + \tan B + \tan C + \tan D$$

$$= \tan A + \tan B + \tan(180 - A) + \tan(180 - B) = 0$$

7. 1

7. Every power of 6 will end in 6.
Therefore least digits of $1+6+6^2+...+6^{2005}$
is $1+2005\times 6=....1$

8. 1

8. The first prime number is 2. The third prime number is 5 and no prime number divides the other prime exactly. Hence the product of first 2007 prime numbers ends with exactly one zero.

PHYSICS

1. A

1. $n = \frac{1}{n}$ (virtual image), object distance, $u = -x$

For mirror

$$m = \frac{-v}{u} = -\frac{\frac{uf}{(u-f)}}{u}$$

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

$$\frac{1}{n} = \frac{f}{f-u}$$

$$\frac{1}{n} = \frac{f}{f-(-x)}$$

$$\frac{1}{n} = \frac{f}{f+x}$$

$$f + x = nf$$

$$x = nf - f$$

$$x = (n-1) f$$

2. D

3. B, C, D

3. Induced current.

4. C

5. B

5. In series combination

$$R = R_1 + R_2$$

In parallel combination

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

6. A, B

6. $R = \rho \frac{L}{A}$

$R \propto \frac{1}{A}$ if ρ & L are constant.

7. B
8. C
9. B
10. D

10. Refractive index of a medium, $\mu_m = \frac{C}{v_m}$

C $\rightarrow$ speed of light is vaccum

$v_m \rightarrow$ speed of light medium

$$v_g = \frac{c}{\mu g}$$

$$v_w = \frac{c}{\mu_w}$$

$$t_w = \frac{h}{v_w} = \frac{h\mu_w}{c}$$

$$t_g = \frac{h}{v_g} = \frac{h\mu_g}{c}$$

$$t_g - t_\omega = \frac{h}{c}\left[\mu_g - \mu_\omega\right]$$

1. A→ r, s   B→ q   C→ r, s   D→ p

1. Right hand thumb rule & $B = \frac{\mu_0 I}{2\pi r}$

2. A→ r   B→ p   C→ s   D→ q

1. 4

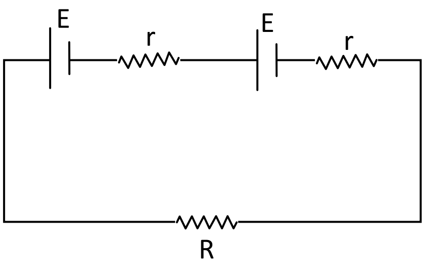
1. Magnetic field at the centre of a current carrying coil is, $B = \frac{\mu_0 I}{2r}$.

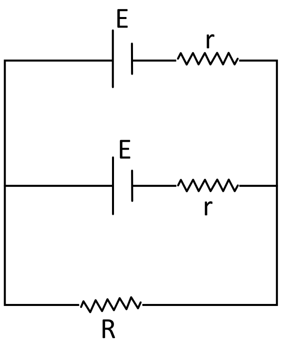
2. 2

3. 4

4. 4

4.





$$R_{net} = r + r + R$$
$$= 2r + R$$
$$I_1 = \frac{2E}{2r+R}$$
$$H_1 = P_1 = I_1^2 R.$$
$$= \frac{4E^2}{(2r+R)^2} R$$

$$R_{net} = \frac{r}{2} + R$$
$$I_2 = \frac{E}{R_{net}}$$
$$= \frac{2E}{r+2R}$$
$$H_2 = P_2 = (I_2)^2 R$$
$$= \frac{4E^2}{(r+2R)^2} R$$

$$\frac{P_1}{P_2} = 2.25 = \frac{225}{100}$$
$$\frac{4E^2R}{(2r+R)^2} \times \frac{(r+2R)^2}{4E^2R} = \frac{225}{100}$$
$$\frac{r+2R}{2r+R} = \frac{15}{10}$$
$$10r + 20R = 30r + 15R$$
$$5R = 30r - 10r$$
$$5R = 20r$$
$$R = \frac{20(1)}{5}$$
$$R = 4\Omega$$

5. 5

6. 2

7. 6

7. $\mu = \dfrac{\sin\left(\dfrac{A+\delta_m}{2}\right)}{\sin\left(\dfrac{A}{2}\right)}$ $A = 60°$ (equilateral triangle)

$$\sqrt{3} = \frac{\sin\left(30° + \dfrac{\delta_m}{2}\right)}{\sin 30}$$
$$\frac{\sqrt{3}}{2} = \sin\left(30 + \frac{\delta_m}{2}\right)$$
$$\sin 60° = \sin\left(30 + \frac{\delta_m}{2}\right)$$
$$60° = 30 + \frac{\delta_m}{2}$$
$$\sin = 60°$$
$$n = 6$$

8. 3

8. $A = 60°(Equilatyeral\ triangle)$

$$ie = \frac{3}{4}A =$$
$$\delta_m = i + e - A$$
$$= 2i - A$$
$$= \frac{3A}{2} - A = \frac{A}{2}$$
$$\delta_m = \frac{A}{2}$$
$$\delta_m = \frac{A}{2}$$
$$= 30°$$
$$n = 3$$