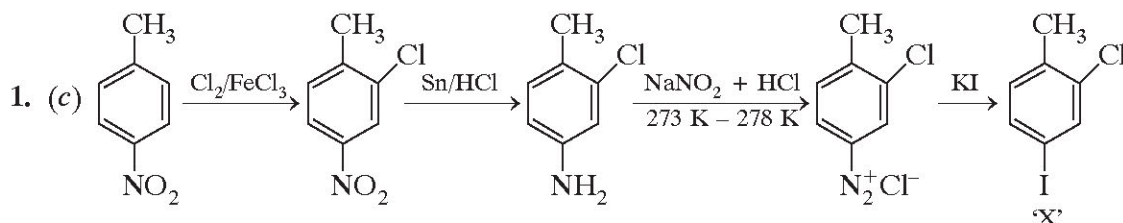


## Answers to RCH/Set-1



3. (b)  $\because \text{Ti}^{2+} > \text{V}^{2+} > \text{Cr}^{2+}$  is order of stability.

4. (c) *p*-dichlorobenzene, being symmetrical fits into crystal lattice readily, therefore, it has highest melting point, *o*-dichlorobenzene has slightly higher than *m*-dichlorobenzene.

5. (c)  $[\text{MnF}_6]^{4-}$  has five unpaired electrons because  $\text{F}^-$  is weak field ligand.

$$\therefore \mu_B = 5.92 \text{ BM}$$

$[\text{Fe}(\text{CN})_6]^{3-}$  has one unpaired electron because  $\text{CN}^-$  is strong field ligand.

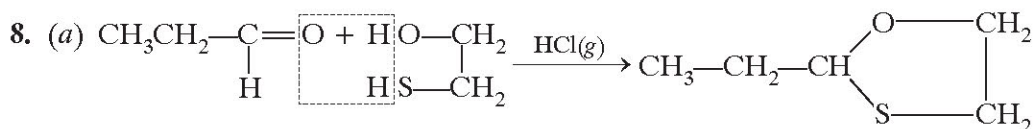
$$\therefore \mu_B = 1.73 \text{ BM}$$

$[\text{Co}(\text{NH}_3)_6]^{3+}$  is diamagnetic due to absence of unpaired electrons.

$$\therefore \mu_B = 0$$

6. (b)  $k = \frac{0.693}{15} = \frac{69.3}{15} \times 10^{-2} = 4.62 \times 10^{-2} = 0.0462 \text{ years}^{-1}$

7. (c) Since  $\text{Eu}^{2+} (4f^7)$  and  $\text{Yb}^{2+} (4f^{14})$  are more stable.



9. (c) Cystein contains 'S' which gets oxidised to  $\text{SO}_4^{2-}$  with conc.  $\text{HNO}_3$ .  $\text{SO}_4^{2-}$  gives white precipitate of  $\text{BaSO}_4$  with  $\text{BaCl}_2(\text{aq})$ .

10. (a) Methyl ketones ( $\text{Ph}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$ ) and  $\text{CH}_3-\overset{\text{OH}}{\text{C}}-\text{CH}_3$ , on oxidation with  $\text{NaOI}$  gives acetone, both give iodoform test.

11. (b) Aniline is least basic because  $C_6H_5$  is electron withdrawing.  $(C_2H_5)_2NH$  is most basic due to more electron density on 'N' as  $C_2H_5$  is electron releasing.

12. (a)  $t_{75\%} = 2t_{1/2} \Rightarrow t_{1/2} = \frac{32}{2} = 16$  min [For first order reaction].

13. (d) A is false but R is true.

$[Co(NH_3)_5SO_4]Cl$  will give white precipitate with  $AgNO_3(aq)$ .

14. (a) Both A and R are true and R is the correct explanation of A.

15. (d) A is false but R is true. Maltose is a reducing sugar.

16. (c) A is true but R is false.

$\therefore R_2 = \frac{R_1 R_4}{R_3}$  is correct relation.

17. (i)  $\pi = iCRT$

$$6 \text{ atm} = i \times \frac{0.2}{4} \times 0.2 \times 300 \text{ K} \Rightarrow i = \frac{24}{12} = 2$$

$$\text{Since } (i) = \frac{M_{\text{theoretical}}}{M_{\text{observed}}} \Rightarrow 2 = \frac{48 + 2 \times 64}{M_{\text{observed}}} \Rightarrow M_{\text{observed}} = \frac{176}{2} = 88 \text{ g/mol}$$

(ii) Difference between observed molar mass and theoretical molar mass  
 $= 176 - 88 = 88$  [ $\because$  Theoretical molar mass is  $48 + 128 = 176$  g/mol]

*Or*

For binary solution

$$(i) [x_A + x_B = 1 \quad \dots(i)] \times 526$$

Total concentration of A and B = 1

(ii) Using Raoult's law

$$P_{\text{Total}} = P_A^\circ X_A + P_B^\circ X_B$$

$$760 \text{ mm} = 526X_A + 11250X_B$$

$$526 \text{ mm} = 526X_A + 526X_B$$

$\dots(ii)$

$$\begin{array}{r} - \qquad - \qquad - \\ \hline 234 = 10724 X_B \end{array}$$

$$\Rightarrow X_B = \frac{234}{10724} = 0.02$$

$$X_A + X_B = 1$$

$$\Rightarrow X_A = 1.00 - 0.02 = 0.98$$

18. (i) The difference in energy of two sets of  $d$ -orbitals ( $d_{xy}$ ,  $d_{yz}$ ,  $d_{zx}$  and  $d_{x^2-y^2}$ ,  $d_{z^2}$ ) is known as crystal field splitting energy.

(ii) Ligands which have two different donor atoms and either of two ligates in the complex is called ambidentate ligand, e.g.  $\text{NO}_2^-$ ,  $\text{SCN}^-$ ,  $\text{CN}^-$ .

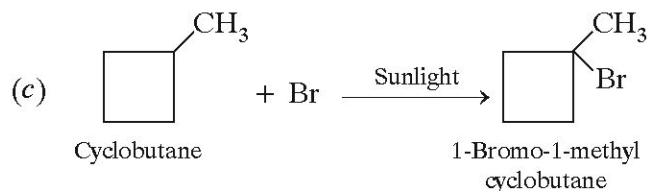
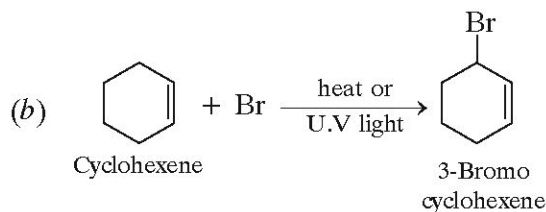
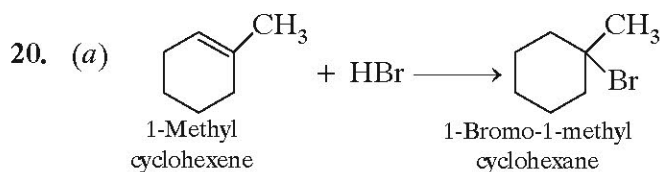
19. (i) Electrode potential of the electrode on the left hand side is given by

$$E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$$

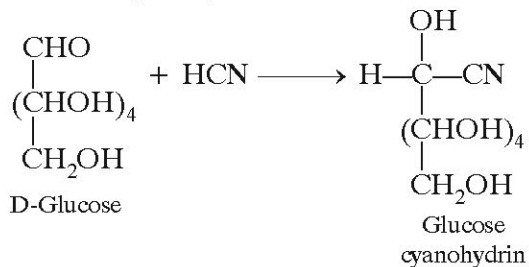
$$\Rightarrow 0.16 \text{ V} = +0.34 \text{ V} - E_{\text{anode}}^{\circ}$$

$$\Rightarrow E_{\text{anode}}^{\circ} = +0.18 \text{ V}$$

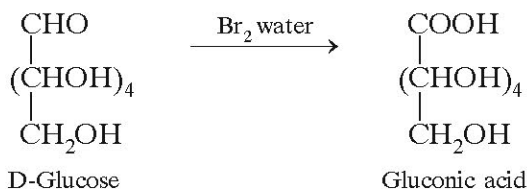
(ii) It allows mobile ions to move through it between the solutions and maintain the charge balance so that current keeps on flowing till potential difference exists.



21. (a) Glucose cyanohydrin is formed.

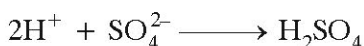


(b) Gluconic acid is formed.



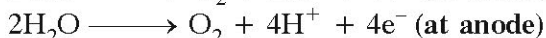
22. (a) In experimental set up I, the blue colour of  $\text{CuSO}_4$  solution will fade away. It is because  $\text{CuSO}_4$  solution will turn into  $\text{H}_2\text{SO}_4$  solution.

Oxidation of water leaves behind  $\text{H}^+$  and reduction of  $\text{Cu}^{2+}$  ion leaves  $\text{SO}_4^{2-}$  ion in the solution.



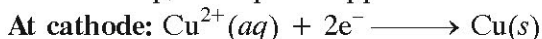
(b)  $\text{Cu}(s) \longrightarrow \text{Cu}^{2+}(aq) + 2e^-$  (at anode)

(c) Oxygen ( $\text{O}_2$ ) is liberated at anode.



(d) Set up II depict the refining of Cu metal.

In this set up, an impure copper rod acts as anode and pure Cu rod acts as cathode.

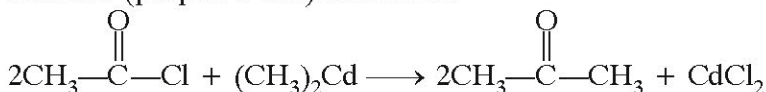


23. (a)  $\text{Mn}^{3+}$  is strong oxidising agent because it can gain one electron to form  $\text{Mn}^{2+}$  ( $3d^5$ ) which is more stable due to half filled  $d$ -orbitals.

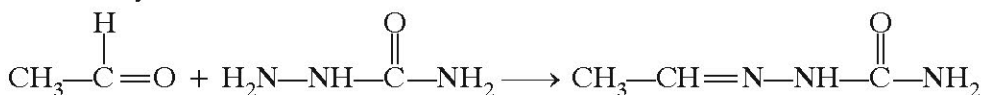
(b)  $\text{Ti}^{4+}$  is colourless because it does not have unpaired electrons and cannot undergo  $d-d$  transitions.

(c)  $\text{Ce}^{4+}$  can gain one electron to form  $\text{Ce}^{3+}$  easily because  $E^\circ_{\text{Ce}^{4+}/\text{Ce}^{3+}} = 1.74 \text{ V}$ .

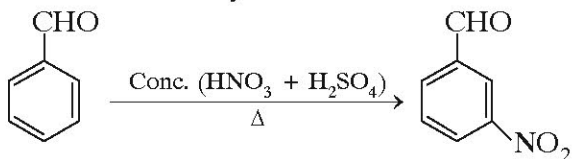
24. (a) Acetone (propan-2-one) is formed.



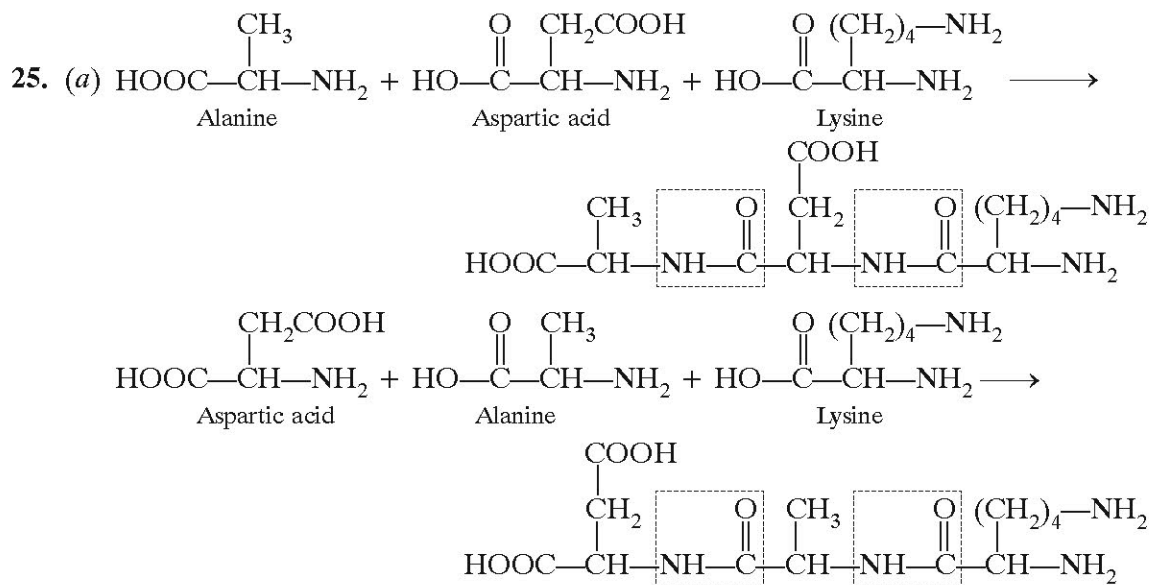
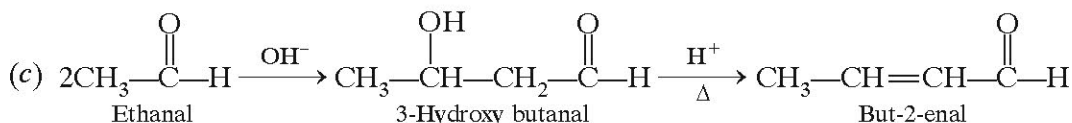
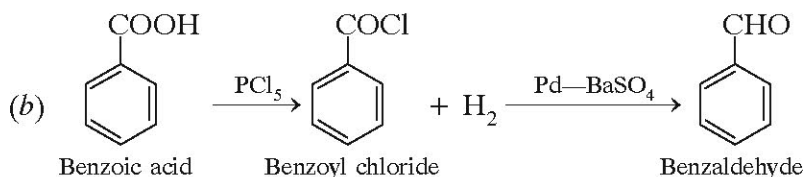
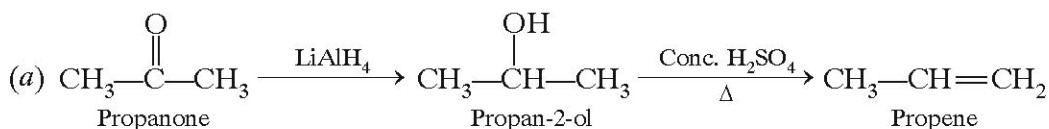
(b) Acetaldehyde semicarbazone is formed.



(c)  $m$ -nitrobenzaldehyde is formed.



Or



(b) In  $\alpha$ -helix of globular proteins a polypeptide chain forms all possible hydrogen bonds by twisting into a right handed screw (helix) with each  $-\text{NH}$  group of each amino acid residue hydrogen bonded to  $\text{C}=\text{O}$  group of an adjacent turn of the helix.

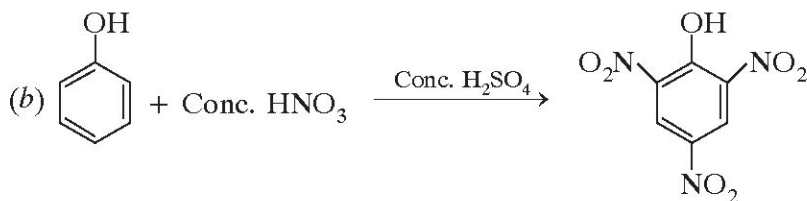
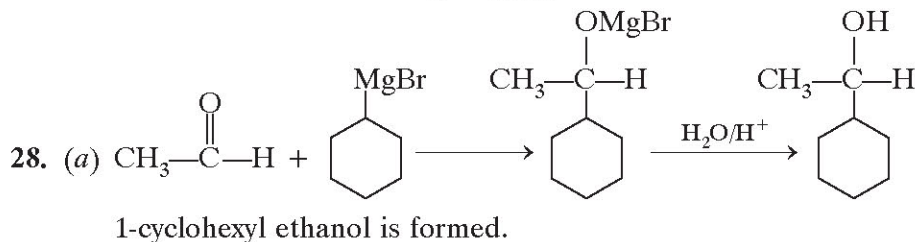
In  $\beta$ -pleated structure of fibrous proteins, all polypeptide chains are stretched out to nearly maximum extension and then laid side by side which are held by inter-molecular hydrogen bonds.

26. (a) In chlorobenzene, phenyl group is electron withdrawing, therefore, it has less dipole moment than cyclohexyl chloride in which cyclohexyl group is electron releasing.  
 (b) Alkyl halides cannot form H-bonds with water and cannot break hydrogen bonds between water molecules.  
 (c) *t*-butyl bromide has less surface area, less van der Waals' forces of attraction than *n*-butyl chloride, hence, lower boiling point.

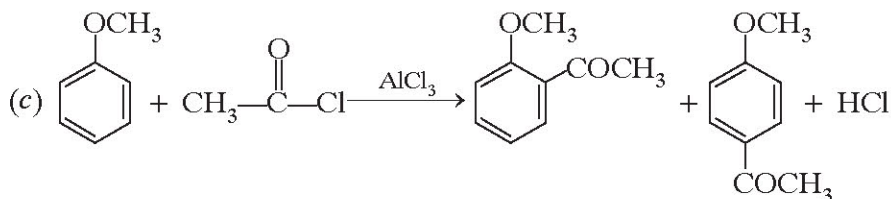
27. 
$$\Lambda_m = \frac{1000 \kappa}{M} = \frac{1000 \times 8 \times 10^{-5}}{2 \times 10^{-3}} = 40 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ} = \frac{40}{404} = 0.099$$

$$\alpha = 9.9\%$$



2, 4, 6-tri nitrophenol (picric acid) is formed.



*o*-methoxy and *p*-methoxy acetophenone are formed.

29. (a) Rate =  $k[\text{NO}_3][\text{NO}]$  (from slow step) ...(i)

$$k_1 = \frac{[\text{NO}_3]}{[\text{NO}][\text{O}_2]} \text{ (from fast step)}$$

$$[\text{NO}_3] = k_1[\text{NO}][\text{O}_2] \text{ ...(ii)}$$

From (i) and (ii), Rate =  $k \times k_1[\text{NO}]^2[\text{O}_2]$

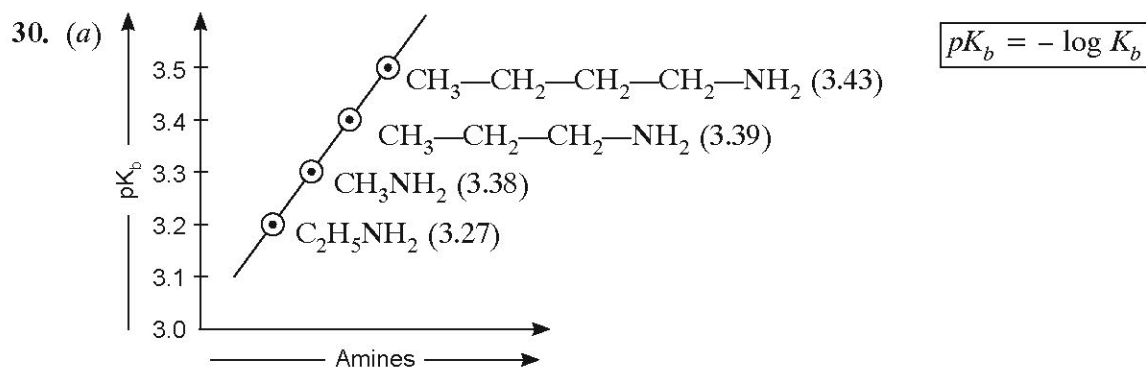
[Unit of rate constant =  $\text{L}^2 \text{ mol}^{-2} \text{ s}^{-1}$ ]

- (b) It is second order reaction because reaction takes in several steps and slowest step determines order of reaction.

Or

No, molecularity cannot be zero or in fraction because number of molecules taking part in elementary reaction are in whole number.

- (c) (i) Step is slow step because rate law involves  $[H_2O_2][I^-]$ .



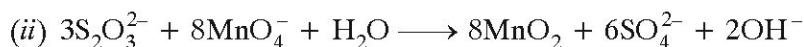
Basic character of ethyl amine is highest, because  $C_2H_5-$  is more electron releasing than  $-CH_3$  group but  $CH_3-CH_2-CH_2-$  and  $CH_3-CH_2-CH_2-CH_2-$  are less electron releasing, therefore, basic character decreases.

- (b) (ii) Diethyl amine is most basic because ethyl group is more electron releasing than  $-CH_3$  group. In  $NH_2-NH_2$  basic character is lowest.  $NH_3$  is less basic than amines.
- (c) (iii)  $\because C_6H_5-$  is electron withdrawing, therefore, it is less basic than aliphatic amines.  $\therefore$  it has highest  $K_b$  and lowest  $pK_b$ .

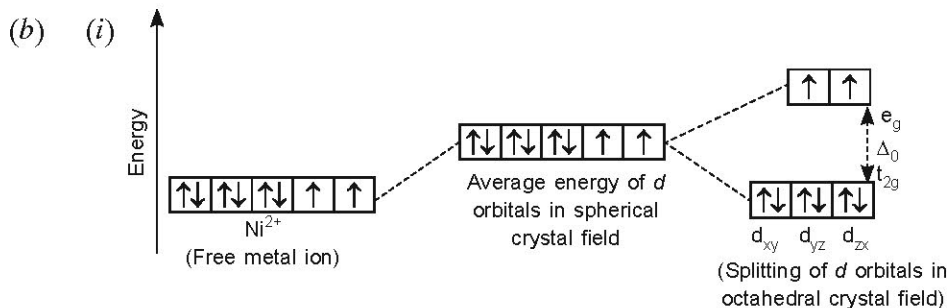
Or

- (c) (i) In  $C_6H_5CH_2NH_2$ ,  $C_6H_5-$  is not directly attached with  $-NH_2$ , therefore, it is more basic: has highest  $K_b$  and lowest  $pK_b$ .

31. (a) (i) Yellow ppt. of sulphur is formed.



Thiosulphate ions will get oxidised to  $SO_4^{2-}$  ions.



(ii)  $sp^3d^2$  hybridisation, because  $Ni^{2+}$  forms outer orbital complex even in presence of strong field ligand ( $NH_3$ ).

(iii) It is paramagnetic due to presence of two unpaired electrons.

Or

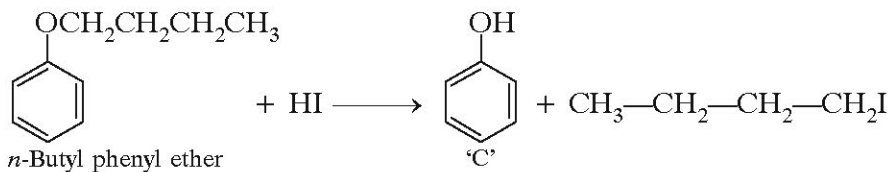
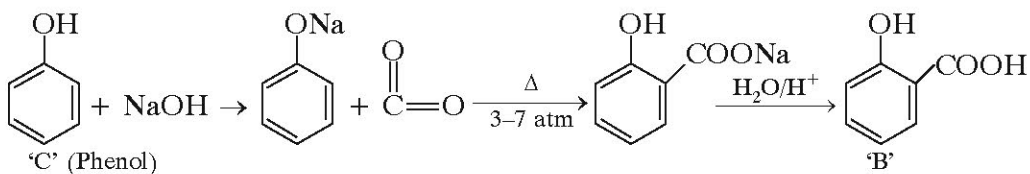
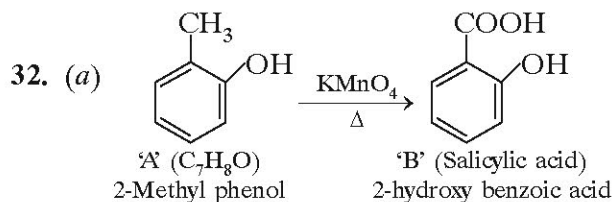
(a) 'A' is  $Co^{-}(-1)$ , 'B' is tetrahedral.  $\therefore x - 0 = 1 \Rightarrow x = -1$

'C' is  $dsp^2$ , 'D' is square planar.

'E' is  $d^2sp^3$ , 'F' is paramagnetic due to presence of one unpaired electron.

(b) (i)  $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 2Fe_2O_3 + 8Na_2CrO_4 + 8CO_2$

(ii)  $2MnO_2 + 4KOH + O_2 \longrightarrow K_2MnO_4 + 2H_2O$









$$\begin{aligned}\Rightarrow 1.5 &= 3.90 \times \frac{W_B}{176} \times \frac{1000}{75} \\ \Rightarrow W_B &= \frac{1.5 \times 176 \times 75}{3.90 \times 1000} \\ &= \frac{19800}{3900} \\ &= 5.0769 \text{ g} = 5.077 \text{ g}\end{aligned}$$