136. In which case change in entropy is negative?

(1) Sublimation of solid to gas

(2) $2H(g) \rightarrow H_2(g)$

(3) Evaporation of water

(4) Expansion of a gas at constant temperature

136. (2)

$2H(g) \longrightarrow H_2(g)$

No. of particle decreases from reactant to product side

137. For the chemical reaction $N_2(g) + 3H_2(g) \square 2NH_3(g)$ the correct option is :

(1) $-\frac{d[N_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$ (2) $3\frac{d[H_2]}{dt} = 2\frac{d[NH_3]}{dt}$

(3) $-\frac{1}{3}\frac{d[H_2]}{dt} = -\frac{1}{2}\frac{d[NH_3]}{dt}$ (4) $-\frac{d[N_2]}{dt} = 2\frac{d[NH_3]}{dt}$

137. (1)

$N_2(g) + 3H_2(g) \square 2NH_3(g)$

$r = -\frac{1}{1}\frac{d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

$\therefore \frac{-d[N_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

138. Which of the folloewing diatomic molecular species has only π bonds according to molecular Orbital Theory ?

(1) C_2 (2) Be_2 (3) O_2 (4) N_2

138. (1)

C_2 $12e^-$ $\sigma 1s^2$ $\sigma^* 1s^2$ $\sigma 2s^2$ $\sigma^* 2s^2 \pi 2p_x^2 = \pi 2p_4^2$

Bo = $\frac{8-4}{2}$ = 2 (where last 4 e^- present in $\pi 2px^2 = \pi 2p_4^2$)

139. Which of the following is incorrect statement?

(1) GeX_4(x = F, Cl, Br, I) is more stable than GeX_2

(2) SnF_4 is ionic in nature

(3) PbF_4 is covalent in nature

(4) $SiCI_4$ is easily hydrolysed

139. (3)

Order of stability of OS

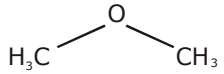
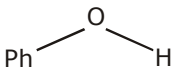
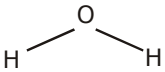
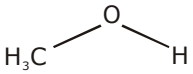
IV A	due to inert pair effect		due to preudo inert gas configuration
Ge	Ge^{2+}	<	Ge^{4+}
	^		
Sn	Sn^{2+}	<	Sn^{4+}
	^		
Pb	Pb^{2+}	>	Pb^{4}

140. Under isothermal condition a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is :
[Given that 1 L bar = 100J]
(1) 25 J (2) 30 J (3) -30 J (4) 5KJ

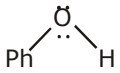
140. (3)

$w = -p_{ext}(V_2 - V_1)$ irreversible
$= -2(0.25 - 0.1)$ isothermal
$= -2\ (0.15)$ expansion
$= -0.3$ lt – bar
$= -0.3 \times 100$ J
$= -30$ J

141. The compound that is most difficult to protonate is :

(1) 
(2) 
(3) 
(4) 

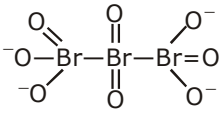
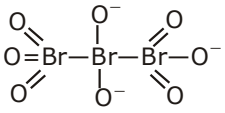
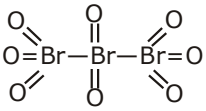
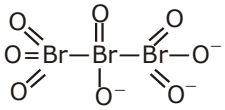
141. (2)

 Lone pair one O–atom is delocalised in benzene ring

142. Which of the following is an amphoteric hydroxide ?
(1) $Mg(OH)_2$ (2) $Be(OH)_2$
(3) $Sr(OH)_2$ (4) $Ca(OH)_2$

142. (2)
$Be(OH)_2$

143. The correct structure of tribromooctaoxide is :

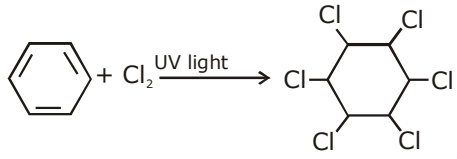
(1) 
(2) 
(3) 
(4) 

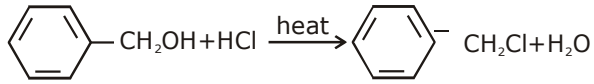
143. (3)

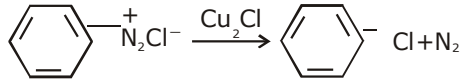
144. The biodegradable polymer is :
(1) nylon-6 (2) Buna-S (3) nylon-6,6 (4) nylon 2-nylon 6

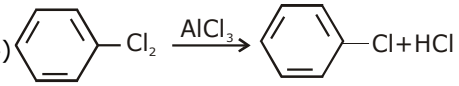
144. (4)
Nylon–2–Nylon – 6 is a biodegradable polymer

145. Among the following, the reaction that proceeds through an electrophilic substitution is :

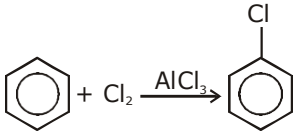
(1) 

(2) 

(3) 

(4) 

145. (4)



Electrophilic substitution reaction

146. Match the following :

(a) Pure nitorgen	(i) Chlorine
(b) Haber process	(ii) Sulphuric acid
(c) Contact process	(iii) Ammonia
(d) Deacon's process	(iv) Sodium azide or Barium azide

Which of the following is the correct option ?

	(a)	**(b)**	**(c)**	**(d)**
(1)	(iii)	(iv)	(ii)	(i)
(2)	(iv)	(iii)	(ii)	(i)
(3)	(i)	(ii)	(iii)	(iv)
(4)	(ii)	(iv)	(i)	(iii)

146. (2)

147. The number of sigma (σ) and pi(π) bonds in pent-2-en-4yne is :

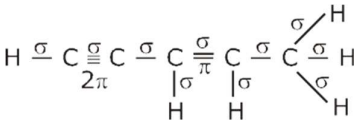
(1) 11 σ bonds and 2π-bonds

(2) 13 σ bonds and no π bond

(3) 10 σ bonds and 3 π bonds

(4) 8 σ bonds and 5 π bonds

147. (3)



10σ and 3π – bonds
Note : Given IUPAC Name is Incorrect

148. Enzymes that utilize ATP in phosphate transfer require an alkaline earth metal (M) as the cofactor M is :
(1) Ca (2) Sr (3) Be (4) Mg

148. (4)
Mg is required in enzymes that utilize ATP in phosphate transfer.

149. Identify the incorrect statement related to PCl_5 from the following:
(1) Axial P–Cl bonds are longer than equatorial P–Cl bonds
(2) PCl_5 molecule is non-reactive
(3) Three equatorial P–Cl bonds make an angle of 120° with each other
(4) Two axial P–Cl bonds make an angle of 180° with each other

149. (2)

150. If the rate constant for a first order reaction is k, the time (t) required for the completion of 99% of the reaction is given by :
(1) t=4.606/k (2)t=2.303/k (3) t=0.693/k (4)t=6.909/k

150. (1)
for 1st order reaction -

$$\square_n \frac{C_0}{C_t} = kt \qquad C_t = \frac{1}{100} C_0$$

$$\Rightarrow \square_n \frac{c_o}{\left(\frac{1C_0}{100}\right)} = kt$$

as 99% of reactant is consumed

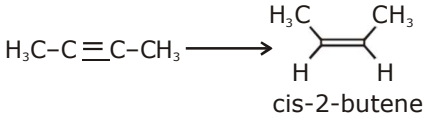
$$\Rightarrow \square_n 100 = kt$$

$$\Rightarrow t = \frac{1}{K} \times 2.303 \ \log 10^2$$

$$\Rightarrow t = \frac{1}{K} \times 2.303 \times 2 \times \log 10$$

$$\Rightarrow t = \frac{4.606}{K}$$

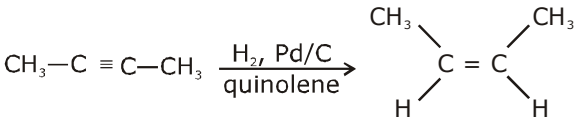
151. The most suitable reagent for the following conversion, is :



cis-2-butene

(1) Zn/HCl (2) Hg^{2+}/H^+, H_2O (3)Na/liquid NH_3 (4) H_2,Pd/C, quinoline

151. (4)



hindlar's Catalyst give Cis-product (syn addition)

152. The manganate and permanganate ions are tetrahedral, due to:

(1) The π–bonding involves overlap of p-orbitals of oxygen with p-orbitals of manganese

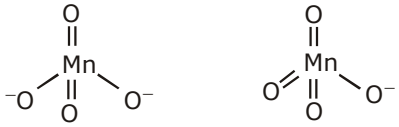
(2) The π–bonding involves overlap of d-orbitals of oxygen with d-orbitals of manganese

(3) The π–bonding involves overlap of p-orbitals of oxygen with d-orbitals of manganese

(4) There is no π-bonding

152. (3)

MnO_4^{2-} MnO_4^-



Mn_{25} $3d^5$ $4s^2$

If bonding takes place by overlap of p orbital of oxygen & d orbital of mn.

153. For a cell involving one electron $E^{\ominus}_{cell}$= 0.59 V at 298K, the equilibrium constant for the cell reaction is:

$$\left[\text{Given that } \frac{2.303\ RT}{F} = 0.059\ \text{V at T=298 K}\right]$$

(1) 1.0×10^{10} (2) 1.0×10^{30} (3) 1.0×10^{2} (4) 1.0×10^{5}

153. (1)

$\Delta G = -nF E^{\circ}_{cell} = -RT \ln k$

$\Rightarrow E^{\circ}_{cell} = \frac{RT}{F} \times 2.303 \times \frac{1}{n} \log k$

$\Rightarrow 0.59 = 0.059 \times \frac{1}{1} \log k$

$\Rightarrow \log k = \frac{0.59}{0.059}$

$\Rightarrow \log k = 10$

$\Rightarrow k = 1 \times 10^{10}$

154. pH of a saturated solution of $Ca(OH)_2$ is 9. The solubility product (K_{sp}) of $Ca(OH)_2$ is :

(1) 0.125×10^{-15} (2) 0.5×10^{-10} (3) 0.5×10^{-15} (4) 0.25×10^{-15}

Ans. (3)

pH = 9

$\therefore$ pOH = 14 – 9 = 5

$[OH^-] = 10^{-5}$

$Ca(OH)_2(s) \square Ca^{2+}(aq) + 2OH^-(aq)$

S 2S = 10^{-5}

$\therefore$ ksp = $[Ca^{2+}] [OH^-]^2$

$= S \times (2S)^2$

$= \frac{10^{-5}}{2} \times (10^{-5})^2$

$= 0.5 \times 10^{-15}$

155. For an ideal solution the correct option is :

(1) Δ_{mix} H =0 at constant T and P (2) Δ_{mix} G =0 at constant T and P

(3) Δ_{mix} S =0 at constant T and P (4) Δ_{mix} V $\neq$ 0 at constant T and P

Ans. (1)

factual

156. A gas at 350 K and 15 bar has molar volume 20 percent smaller than that for an ideal gas under the same conditions. The correct option about the gas and its compressibility factror (Z) is:

(1) Z < 1 and attractive forces are dominant

(2) Z < 1 and repulsive forces are dominant

(3) Z > 1 and attractive forces are dominant

(4) Z > 1 and repulsive forces are dominant

Ans. (1)

$$z = \frac{(PV)_{real}}{(PV)_{ideal}}$$

as real volume is lesser than an ideal gas volume

$\therefore$ z < 1

and for z < 1, attractive forces dominant

157. The correct order of the basic strength of methyl substituted amines in aqueous solution is **:**

(1) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$

(2) $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$

(3) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$

(4) $(CH_3)_3N > CH_3NH_2 > (CH_3)_2NH$

Ans. (3)

Correct order of basic strength of methyl substituted amines is

$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$ ($2^o > 1^o > 3°$)

158. For the second period elements the correct increasing order of first ionisation enthalpy is:

(1) Li < B < Be <C <N < O < F < Ne

(2) Li < Be< B < C < O < N < F < Ne

(3) Li < Be < B < C < N < O < F < Ne

(4) Li < B < Be < C < O < N < F < Ne

Ans. (4)

159. Which mixture of the solutions will lead to the formation of negatively charged colloidal $[AgI]I^-$ Ans?

(1) 50 mL of 2 M $AgNO_3$ + 50 mL of 1.5 M KI

(2) 50 mL of 0.12 M $AgNO_3$ + 50mL of 0.1 M KI

(3) 50 mL of 1 M $AgNO_3$ + 50 mL of 1.5 M KI

(4) 50 mL of 1 M $AgNO_3$ + 50 mL of 2M KI

Ans. (3,4)

If in KI solution $AgNO_3$ is added than it will form –vely charged $[AgI]I^-$ colloid. If in $AgNO_3$ solution KI is added it will form AgI/Ag^+ (positively charged) colloid.

160. For the cell reaction $2Fe^{3+}(aq) + 2I^-(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(aq)$

$E^{\ominus}_{cell} = 0.24V$ at 298K. The standard Gibbs energy ($\Delta_r G^{\ominus}$) of the cell reaction is:

(Given that Faraday constant F = 96500 C mol^{-1})

(1) 46.32 kJ mol^{-1} (2) 23.16 kJ mol^{-1} (3) –46.32 kJ mol^{-1} (4) –23.16 kJ mol^{-1}

Ans. (3)

$\Delta G°_{cell} = -nFE°_{cell}$

$= -2 \times 96500 \times 0.24 = -46320$ J/Mol $= -46.32$ J/Mol

161. Which is the correct thermal stability order for H_2E (E = O, S, Se, Te and Po)?

(1) $H_2Po < H_2Te < H_2Se < H_2S < H_2O$ (2) $H_2Se < H_2Te < H_2Po < H_2O < H_2S$

(3) $H_2S < H_2O < H_2Se < H_2Te < H_2Po$ (4) $H_2O < H_2S < H_2Se < H_2Te < H_2Po$

Ans. (1)

162. The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is:

(1) 30 (2) 40 (3) 10 (4) 20

Ans. (1)

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

$$\frac{n_{H_2}}{3} = \frac{n_{NH_3}}{2}$$

$$\Rightarrow n_{H_2} = \frac{3}{2} \times 20 \Rightarrow n_{H_2} = 30 \text{ moles}$$

163. Which of the following series of transitions in the spectrum of hydrogen atom falls in visible region?

(1) Paschen series (2) Brackett series (3) Lyman series (4) Balmer series

Ans. (4)

Factual

164. A compound is formed by cation C and anion A. The anions form hexagonal close packed (hcp) lattice and the cations occupy 75% of octahedral voids. The formula of the compound is:

(1) C_3A_4 (2) C_4A_3 (3) C_2A_3 (4) C_3A_2

Ans. (1)

(c) OV : hcp(A)

$6 \times \frac{75}{100}$: 6

$\frac{3}{4}$: 1

3 : 4

165. The non-essential amino acid among the following is:

(1) alanine (2) lysine (3) valine (4) leucine

Ans. (1)

166. An alkene "A" on reaction with O_3 and Zn – H_2O gives propanone and ethanal in equimolar ratio. Addition of HCl to alkene "A" gives "B" as the major product. The structure of product "B" is:

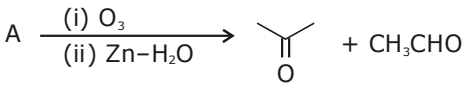
(1) $H_3C - CH_2 - \underset{\displaystyle Cl}{\overset{\displaystyle CH_3}{\underset{|}{\overset{|}{C}}}} - CH_3$

(2) $H_3C - \underset{\displaystyle Cl}{\underset{|}{CH}} - \overset{\displaystyle CH_3}{\overset{|}{CH}} - CH_3$

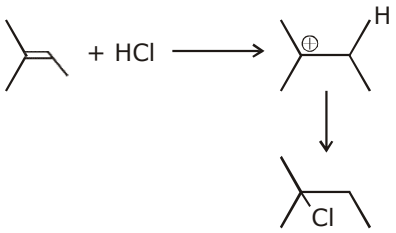
(3) $Cl - CH_2 - CH_2 - \overset{\displaystyle CH_3}{\overset{|}{CH}} - CH_3$

(4) $H_3C - CH_2 - \overset{\displaystyle CH_2Cl}{\overset{|}{CH}} - CH_3$

Ans. (1)



So, (A) should be 



167. Which of the following species is not stable?

(1) $[Sn(OH)_6]^{2-}$ (2) $[SiCl_6]^{2-}$ (3) $[SiF_6]^{2-}$ (4) $[GeCl_6]^{2-}$

Ans. (2)

168. Match the Xenon compounds in Column–I with its structure in Column-II and assign the correct code :

Column –I	**Column – II**
(a) XeF_4	(i) Pyramidal
(b) XeF_6	(ii) square planar
(c) $XeOF_4$	(iii) Distorted octahedral
(d) XeO_3	(iv) Square Pyramidal

Code :

	(a)	(b)	(c)	(d)		(a)	(b)	(c)	(d)
(1)	(ii)	(iii)	(i)	(iv)	(2)	(iii)	(iv)	(i)	(ii)
(3)	(i)	(ii)	(iii)	(iv)	(4)	(ii)	(iii)	(iv)	(i)

Ans. (4)

169. Among the following, the one that is not a green house gas is :

(1) ozone (2) sulphur dioxide (3) nitrous oxide (4) methane

Ans. (2)

SO_2

170. Which of the following reactions are disproportionation reaction ?

(a) $2Cu^{+} \rightarrow Cu^{2+} + Cu^{0}$ (b) $3MnO_4^{2-} + 4H^{+} \rightarrow 2MnO_4^{-} + MnO_2 + 2H_2O$

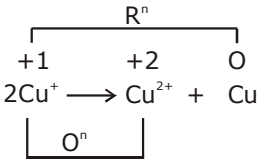
(c) $2KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$ (c) $2MnO_4^{-} + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^{\oplus}$

Select the **correct** option from the following :

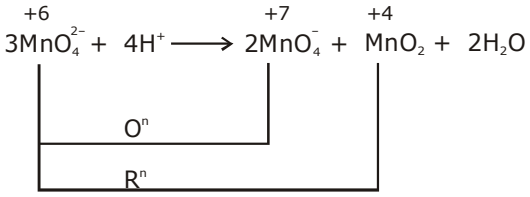
(1) (a), (c) and (d) (2) (a) and (d) only (3) (a) and (b) only (4) (a), (b) and (c)

Ans. (3)

(a)

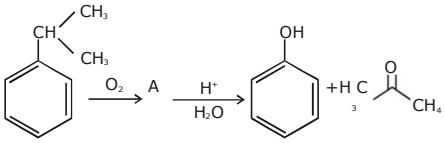


(b)

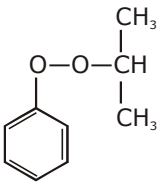


∴ (a) & (b) are disproportionation reaction

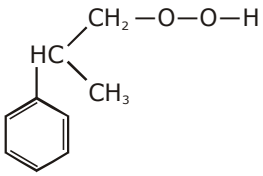
171. The structure of intermediate A in the following reaction, is :



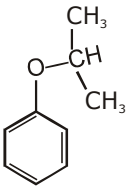
(1)



(2)



(3)



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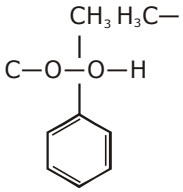
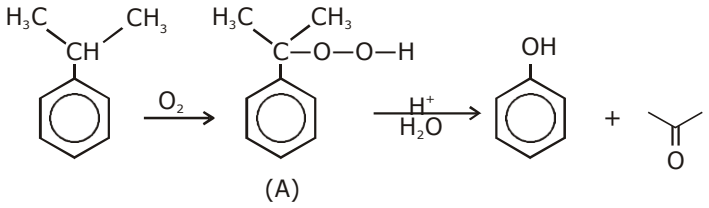


Ans. (4)



(A)

172. The mixture that forms maximum, boiling azeotrope is :

(1) Acetone + Carbon disulphide (2) Heptane + Octane

(3) Water + Nitric acid (4) Ethanol + Water

Ans. (3)

factual

Water + Nitric Acid

173. What is the correct electronic configuration of the central atom in K_4 $[Fe(CN)_6]$ based on crystal field theory?

(1) $e^3t_2^3$ (2) $e^4t_2^2$ (3) $t_{2g}^4e_g^2$ (4) $t_{2g}^6e_g^0$

Ans. (4)

174. Conjugate base for Bronsted acids H_2O and HF are :

(1) OH^- and F^-, respectively (2) H_3O^+ and H_2F^+, respectively

(3) OH^- and H_2F^+, respectively (4) H_3O^+ and F^-, respectively

Ans. (1)

$H_2O \xrightarrow{-H^+} OH^-$ Conjugate base

$H_2O \xrightarrow{-H^+} F^-$ Conjugate base

175. Which will make basic buffer?

(1) 100 mL of 0.1 M HCl + 200 mL of 0.1 M NH_4OH

(2) 100 mL of 0.1 M HCl + 100 mL of 0.1 M NaOH

(3) 50 mL of 0.1 M NaOH + 25 mL of 0.1 M CH_3COOH

(4) 100 mL of 0.1 M CH_3COOH + 100 mL of 0.1 M NaOH

Ans. **(1)**

$HCl + NH_4OH \rightarrow NH_4Cl + H_2O$

(1) Equni.	$M\times V\times nf$	$M\times V\times nf$		
	$0.1\times\frac{100}{1000}\times1$	$0.1\times\frac{200}{1000}\times1$	0	-
	initially 0.01	0.02	0	-
	final 0	0.01	0.01	-

$\therefore$ weak base & its conjugate salt It will form a basic buffer solution.

(1) Trick : Only in option (1) weak base is given, then only it can form basic buffer no calculation required.

176. 4d, 5p,5f and 6p orbitals are arranged in the order of decreasing energy . The correct option is:

(1) 6p > 5f > 4d > 5p (2) 5f > 6p > 4d > 5p

(3) 5f > 6p > 5p > 4d (4) 6p > 5f > 5p > 4d

Ans. **(3)**

using (n+l) rule

	n	l	(n+l)	
5f	5	3	8	
6P	6	1	7	
5P	5	1	6	lower value of 'n' signifies lower energy.
5d	4	2	6	

5f > 6P > 5P > 4d

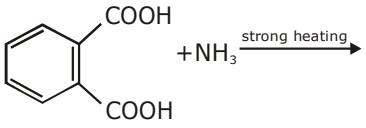
177. Among the following the narrow spectrum antibiotic is :

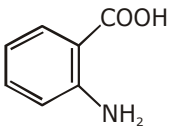
(1) amoxycillin (2) chloramphenicol (3) penicillin G (4) ampicillin

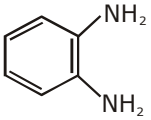
Ans. **3**

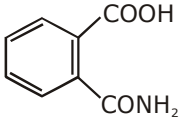
Penicillin G is narrow spectrum antibiotic.

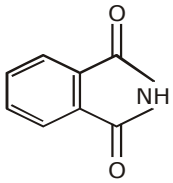
178. The major product of the following reaction is :



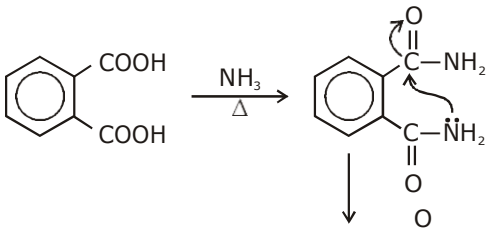
(1) 

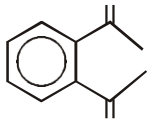
(2) 

(3) 

(4) 

Ans. 4





Phthalimide

179. The method used to remove temporary hardness of water is :

(1) Ion - exchange method (2) Synthetic resins method

(3) Calgon's method (4) Clark's method

Ans (4)

180. Which one is malachite from the following?

(1) Fe_3O_4 (2) $CuCO_3.Cu(OH)_2$

(3) $CuFeS_2$ (4) $Cu(OH)_2$

Ans (2)