General

[SPM10-39] Which statement defines oxidation?

A Increases in oxidation number
B Gain of hydrogen
C Loss of oxygen
D Gain of electron

[MRSM06-39] The equation represents the redox reaction between ammonia and copper(II) oxide.

$$2\ NH_3 + 3CuO \text{ -- > } N_2 + 3\ Cu + 3H_2O$$

Which of the following is true about the reaction?

A Ammonia is an oxidizing agent
B Nitrogen is a reducing agent
C Oxidation number of copper decreases from +2 to 0
D Oxidation number of hydrogen increases from -1 to +1

[SPM03-28] Below is an ionic equation.

$$X(s) + Y^{2+}(aq) \longrightarrow X^{2+}(aq) + Y(s)$$

Which of the following is true of the equation?

A Y^{2+} is oxidized
B X is an oxidizing agent
C X^{2+} is a reducing agent
D X donates electrons to Y^{2+}

[SBPTrial09-11] Which of the following is a reduction process?

A A copper(II) ion gains two electrons
B Hydrogen sulphide loses its hydrogen
C Iron(II) ion converted to iron(III) ion
D A magnesium atom loses two electrons

[SPM08-16] Which of the following is an oxidation process?

A Carbon dioxide loses oxygen
B A bromine atom gains an electron
C A chlorine molecules gains hydrogen
D A sodium atom loses an electron

[SPM09-04] Which of the following cannot occur during oxidation?

A Gain of oxygen
B Donation of electron
C loss of hydrogen
D decrease in oxidation number

[MRSM05-17] Which of the following statements refer to oxidation?

I Process of losing oxygen
II Process of gaining hydrogen
III Process of losing electrons
IV Process of increasing oxidation number.

A I and II only
B III and IV only
C I, II and III only
D I, II , III and IV.

[MRSM07-18] Which of the following is an oxidation process?

A Propene changes into propane
B Lead(II) oxide loses its oxygen
C Magnesium atom forms magnesium ion.
D Chlorine molecule gains electrons.

[MRSM09-15] The following equation represents the oxidation of magnesium atom.

$$Mg \rightarrow Mg^{2+} + 2e-$$

What is meant by oxidation based on the equation?

A Electrons are received by magnesium ion
B Electrons are donated by magnesium ion
C Electrons are received by magnesium atom
D Electrons are donated by magnesium atom

[SPM03-11] Below is the half equation of a reaction

$$2Br^- \text{ -- > } Br_2 + 2e$$

What is meant by oxidation reaction based on the equation?

A Electrons are received by bromine
B Electrons are donated by bromine
C Electrons are received by bromine ions
D Electrons are donated by bromine ions

[SBPtrial11-11] The following is the half equation of a reaction.

$$Cl_2 + 2e \rightarrow 2\ Cl^-$$

What is meant by reduction reaction based on the equation?

A Electrons are received by chlorine
B Electrons are donated by chlorine
C Electrons are received by chloride ions
D Electrons are donated by chloride ions

[SBPtrial11-37] Which of the following equations represent a redox reaction?

I	CuO	+	H_2SO4	→	$CuSO_4$	+	H_2O	
II	$2\ HCl$	+	Zn	→	$ZnCl_2$	+	H_2	
III	Ag^+	+	Cl^-	→	$AgCl$			
IV	Cl_2	+	$2\ I^-$	→	$2\ Cl^-$	+	I_2	

A I and II
B II and IV
C I and III
D III and IV

[MRSM11-33] Which of the following reactions is a redox reaction?

I	CuO	+	Zn	→	ZnO	+	Cu	
II	HCl	+	$NaOH$	→	$NaCl$	+	H_2O	
III	$Pb(NO_3)_2$	+	$2\ KI$	→	PbI_2	+	$2\ KNO_3$	
IV	Mg+	$2\ AgNO_3$		→	$Mg(NO_3)_2$	+	$2\ Ag$	

A I and IV
B II and III
C I, II and III
D II, III and IV

[SBPtrial10-12] Which of the following chemical equation, not redox reaction?

A	$Ag^+_{(aq)}$	+	Cl-(aq)	→	$AgCl_{(s)}$			
B	$Cl_{2(g)}$	+	$S^{2-}{}_{(aq)}$	→	$2Cl^-{}_{(aq)}$	+	$S_{(s)}$	
C	$2\ Fe^{3+}{}_{(aq)}$	+	$Zn\ (s)$	→	$2\ Fe^{2+}{}_{(aq)}$	+	$Zn^{2+}{}_{(aq)}$	
D	$Mg_{(p)}$	+	$Cu^{2+}{}_{(aq)}$	→	$Mg^{2+}{}_{(aq)}$	+	$Cu_{(s)}$	

Calculation of Oxidation Number

[SPM11-49] What is the oxidation number of the chromium element in potassium dichromate(VI), $K_2Cr_2O_7$?

A +2
B +3
C +5
D +6

[SPM10-41] What is the oxidation number of X in $X_2O_3^{2-}$ ion?

A +2
B +4
C -2
D -4

[SPM07-17] What is the oxidation number of oxygen in oxygen gas, O_2?

A -2
B -1
C 0
D +1

[MRSM05-46] What is the oxidation number of sulphur in $Na_2S_2O_3$?

A +2
B +3
C +4
D +6

[SPM09-35] What is the oxidation number of chromium in K_2CrO_4?

A +6
B +3
C +2
D +1

[SPM04-47] What is the oxidation number of manganese in the ion MnO_4^-?

A +2
B +3
C +7
D +8

[SPM06-17] What is the oxidation number for oxygen in the thiosulphate ion, $S_2O_3^{2-}$?

A -3
B -2
C +2
D +3

[MRSM09-47] Which of the underlined elements has the highest oxidation number?

A $K_2\underline{\mathbf{Cr_2}}O_7$
B $\underline{\mathbf{Fe_2}}(SO_4)_3$
C $\underline{\mathbf{Pb}}Cl_4$
D $\underline{\mathbf{Cu_2}}O$

[MRSM03-27] What is the oxidation number of chlorine in the following molecules or ions?

	$\mathbf{ClO^-}$	$\mathbf{ClO_3^-}$	$\mathbf{Cl_2O_7}$
A	+1	-5	+7
B	+1	+5	-7
C	+1	+5	+7
D	-1	+5	+7

[SPM08-46|SBPTrial07-37] The manufacture of sulphuric acid in the Contact Process involves the following steps.

$$\mathbf{S \quad --> \quad SO_2 \quad --> \quad SO_3 \quad --> \quad H_2SO_4}$$

Which of the following shows the correct sequence of change in oxidation number of sulphur?

A	0	-- > +2	--> +3	-- > +4
B	0	-- > +2	-- > +6	-- > +6
C	0	-- > +4	-- > +6	-- > +6
D	0	-- > +4	-- > +6	-- > +8

[SBPtrial10-23] The following chemical equation shows one redox reaction.

$$3\ H_2S_{(g)} + 2\ HNO_{3(aq)} \rightarrow 3S_{(p)} + 2\ NO_{(g)} + 4\ H_2O_{(l)}$$

Which of the following oxidation number in this reaction is correct?

A Oxidation number of hydrogen change from -1 to +1
B Oxidation number of nitrogen change from +5 to +2
C Oxidation number of oxygen change from -1 to -2
D Oxidation number of sulphur change from -1 to 0

Displacement of Metal

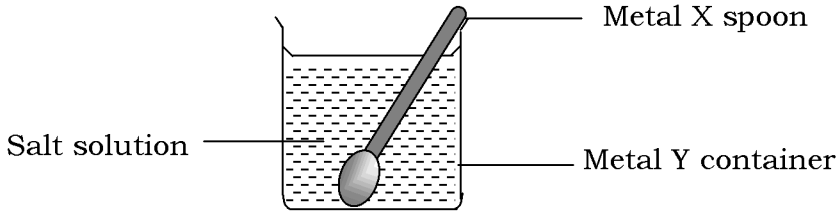
[SPM11-40] The following equation shows the displacement of metal Y from its salt solution.

$$X + Y(NO_3)_2 \rightarrow X(NO_3)_2 + Y$$

What are metal X and metal Y?

	X	Y
A	Zinc	Magnesium
B	Zinc	Iron
C	Copper	Magnesium
D	Copper	Iron

[SBPTrial08-20] Diagram 6 shows a metal X spoon dipped in a salt solution inside metal Y container.



If element X is more electropositive than Y, which of the following statements are true about the diagram?

I Metal X spoon undergoes corrosion
II Metal Y is oxidised
III Mass of metal X spoon decreases
IV Atom of metal X spoon is ionised

A I and III only
B II and IV only
C I, III and IV only
D I, II, III and IV

[MRSM10-49] The following equations represent the displacement reaction of metals.

Reaction I : $E + G^{2+} \rightarrow E^{2+} + G$

Reaction II : $L + E^{2+} \rightarrow L^{2+} + E$

Which of the following statement is true?

A E and G are oxidised
B E is more electropositive than L.
C G is lower than L in the Electrochemical Series.
D G can displace E from its salt solution.

[SBPTrial09-22] The following equation shows the redox reaction between copper and silver nitrate solution.

$$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$$

Which of the following statements is true about this reaction?

A Silver ion is oxidised
B Copper is the oxidising agent
C The oxidation number of copper increases
D The oxidation number of nitrogen decreases

[MRSM05-32] The oxidation number of copper increases when

A Copper(II) carbonate powder is strongly heated
B Copper(II) oxide reacts with dilute sulphuric acid
C A piece of zinc strip reacts with copper(II) nitrate solution
D A piece of copper strip reacts with silver nitrate solution

Displacement of Halide

[SPM04-29] The table shows the results of a reaction between halogen and halide solution to determine the reactivity of the halogen.

Halogen / **Halide solution**	**Chlorine**	**Bromine**	**Iodine**
Potassium bromide	Reaction occurs		No reaction
Potassium iodide	Reaction occurs	Reaction occurs	

The reactivity series of halogens in descending order is

A bromine, chloride, iodide
B chloride, bromide, iodide
C iodine, bromine, chloride
D iodide, chloride, bromine

[SPM05-33] A redox reaction can be represented by the following equation.

$$\mathbf{X_2\ (aq) + 2\ KBr\ (aq) \longrightarrow 2KX(aq) + Br_2(aq)}$$

Element X is in Group 17 in the Periodic Table of Elements. What can be observed if element X is replaced with iodine?

A Brown gas is produced
B Colourless solution is produced
C No change is observed
D Brown colour of the iodine is decolourized

[MRSM07-48] Table 5 shows the result of three experiments involving halogen displacement.

Experiment	Halogen added	Halide solution		
		X^-	Y^-	Z^-
I	X_2	-	Y_2 produced	Z_2 produced
II	Y_2	No reaction	-	No reaction
III	Z_2	No reaction	Y_2 produced	-

What are halogens X, Y and Z?

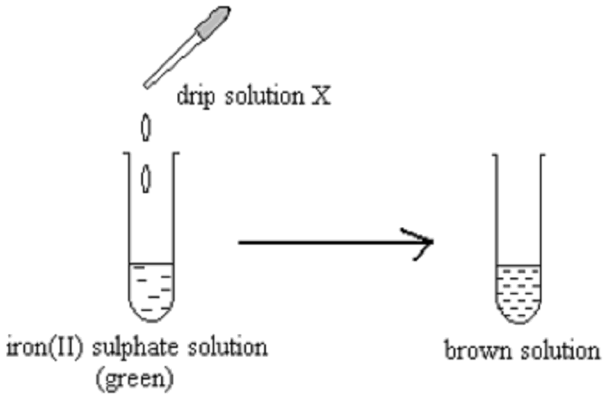
	X	Y	Z
A	Br	Cl	I
B	Br	I	Cl
C	Cl	I	Br
D	Cl	Br	I

[MRSM04-30] Which of the following observations for the different mixtures of reactants is correct?

	Mixture of reactants	The colour of tetra chloromethane layer
A	Potassium iodide solution + bromine water + tetrachloromethane	Brown
B	Potassium chloride solution + bromine water + tetrachloromethane	Colourless
C	Potassium iodide solution + chlorine water + tetrachloromethane	Purple
D	Potassium bromide solution + iodine water + tetrachloromethane	Brown

Conversion iron || iron(II) to iron (III) | Iron(III) to iron(II)

[MRSM06-36] Diagram shows an experiment carried out for iron(II) sulphate.



Which of the following is solution X?

A Potassium chloride solution
B Potassium bromide solution
C Sodium hydroxide solution
D Acidified potassium manganate(VII) solution

[MRSM04-25] The reaction between chlorine water and iron(II) sulphate solution is a redox reaction. Which of the following is true?

A Iron(II) ion is an oxidizing agent.
B Electron is transferred from chlorine to iron(II) ion.
C The oxidation number of chlorine reduces from 0 to -1.
D The colour of the mixture changes from brown to green.

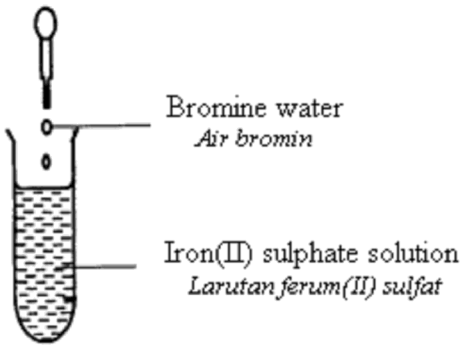
[MRSM05-18] The following ionic equation represents a redox reaction

$$2\ Fe^{2+} + Br_2 \ \text{-- >}\ 2\ Fe^{3+} + 2\ Br^-$$

Which of the following statements is true?

A Iron(II) ion , Fe^{2+} has been oxidized
B Iron(III) ion , Fe^{3+} has been reduced
C Bromine is the reducing agent
D Oxidation number of bromine increases from +1 to +2

[MRSM09-16] Diagram 6 shows the changes of iron(II) sulphate to iron (III) sulphate using bromine water.



Which of the following is true regarding the reaction?

A Iron(II) ions are reduced
B Bromine water is oxidized
C Green solution turns brown
D Iron(II) ions gain electron

[MRSM07-17] Reaction between iron(II) sulphate solution and bromine can be represented by the following equation.

$$2\ Fe^{2+} + Br_2 \rightarrow 2\ Fe^{3+} + 2\ Br^-$$

Which of the following is true about the reaction?

A Fe^{2+} is reduced
B Br_2 is a reducing agent
C Fe^{2+} is an oxidizing agent
D Br_2 accepts electrons

[SPM03-35] An equation of a reaction is as follows:

$$\underset{\text{Green}}{2Fe^{2+}} + Cl_2 \longrightarrow \underset{\text{brown}}{2\,Fe^{3+}} + 2\,Cl^-$$

In the reaction represent by the equation above, it was found that the change of colour from green to brown was faster when the reactant mixture was heated. This was due to the

I decrease in the activation energy
II increase in the frequency of effective collision
III increase in the kinetic energy of iron(II) ions and chlorine molecules.
IV increase in the frequency of collision between iron(II) ions and chlorine molecules.

A I and II only
B II and III only
C I, III and IV only
D II, III and IV only

[SBPTrial08-11] The following ionic equation shows a redox reaction.

$$2Fe^{2+} + Br_2 \rightarrow 2Fe^{3+} + 2Br^-$$

Which of the following is true about the reaction?

A Iron(III) ion, Fe^{3+} is reduced
B Iron(II) ion, Fe^{2+} is oxidised
C Bromine water is a reducing agent
D Bromide ion is an oxidising agent

[SPM09-12] Which substance can be used to convert Fe^{2+} ions to Fe^{3+} ions?

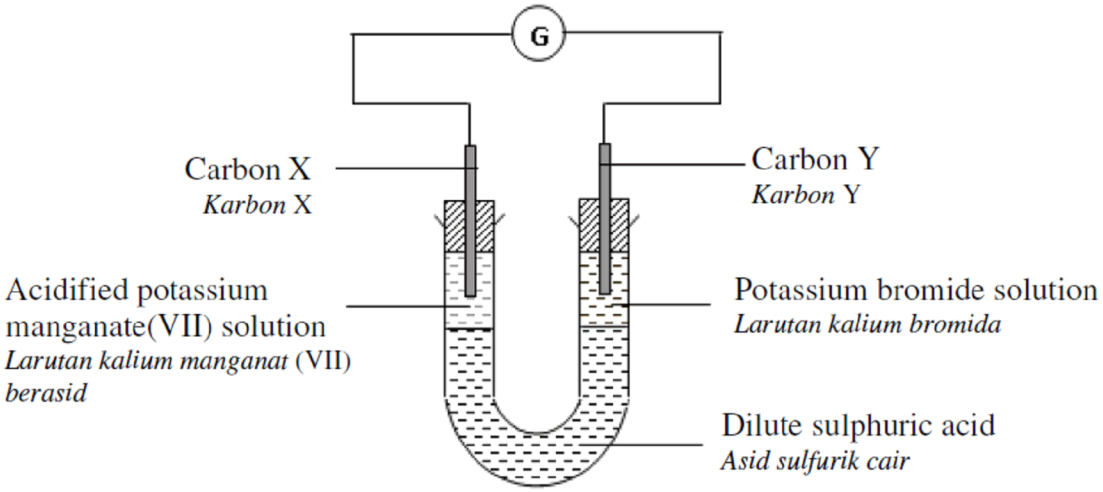
A Magnesium
B Sulphur dioxide gas
C potassium manganate (VII) solution
D Acidified potassium dichromate (VI) solution

[SPM03-29] Fe^{3+} ion in solution can be converted to Fe^{2+} ions by adding zinc powder. Which of the following can replace zinc powder in this reaction?

A Bromine water
B Potassium iodide solution
C Potassium hexacynaferrate(II) solution
D Acidified potassium manganate (VII) solution

U Tube

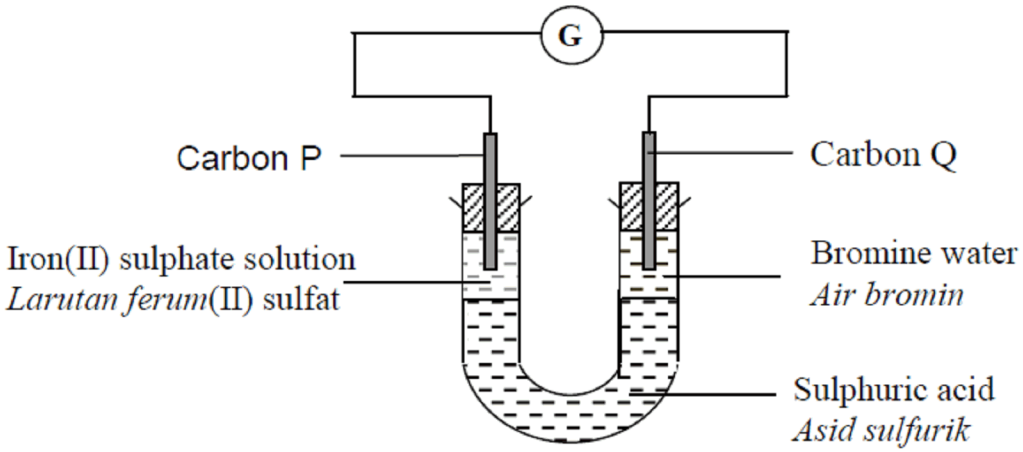
[MRSM11-45] Diagram 18 shows an apparatus set-up for a redox reaction.



Which of these statements is correct?

A The colour of solution at electrode Y does not change
B Electron flows from electrode X to electrode Y
C The purple solution at electrode X decolourises
D Sulphuric acid acts as the reducing agent

[SBPtrial11-49] Diagram 14 shows the apparatus arrangement to investigate the oxidation and reduction in terms of the transfer of electron at a distance.



Which of the following represents the half equation for reaction occurs at P and Q electrode.

	P	Q
A	$Fe^{2+} \rightarrow Fe^{3+} + e$	$Br_2 + 2e \rightarrow 2\ Br^-$
B	$Fe^{2+} \rightarrow Fe^{3+} + e$	$C + 4e \rightarrow C^{4-}$
C	$2\ SO_4^{2-} \rightarrow S_2O_8^{2-} + 2e$	$Br_2 + 2e \rightarrow 2\ Br^-$
D	$Fe \rightarrow Fe^{2+} + 1e$	$2\ Br^- \rightarrow Br_2 + 2e$

[SBPtrial10-49] Diagram 11 show set-up apparatus one cell U-tube. Sulfurus acid, H_2SO_3 react with chlorine water as chemical equation below.

$$H_2SO_{3(aq)} + Cl_{2(aq)} + H_2O_{(l)} \rightarrow H_2SO_{4(aq)} + 2HCl_{(aq)}$$

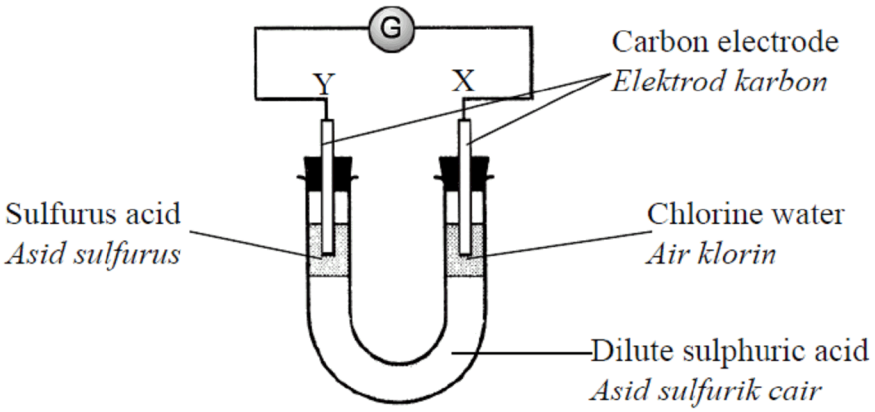
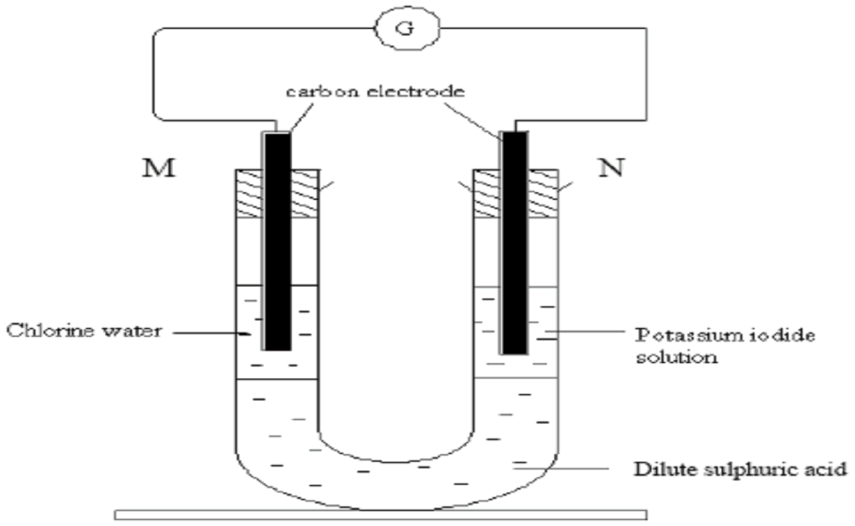


Diagram 11

Which of the following statement is true about cell U-tube?

A Sulfurus acid is reduced
B Electron move from electrode Y to elektrode X throught wire
C Clorin acts as reducing agent
D Half equation at electrode X, $2Cl^-_{(aq)} \rightarrow Cl_{2(aq)} + 2e^-$

[MRSM05-33] The diagram shows an experiment of transferring electron at a distance

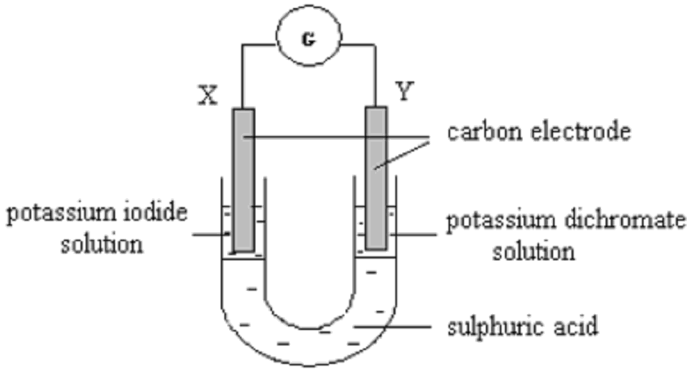


Which of the following statements are true?

I Iodide ions act as a reducing agent
II A yellow-brownish solution is formed at N electrode
III Electrons transfer through the sulphuric acid solution
IV Yellow-greenish bubbles is released at M electrode

A I and II only
B II and III only
C I, III and IV only
D I, II, III and IV

[MRSM06-34] The diagram shows the apparatus set-up of an experiment to study redox reaction. After 20 minutes, the colourless solution around electrode X changes to brown while the solution around electrode Y changes from orange to green.



Which of the following statement explains the observation of the experiment?

A Iodide ions are oxidized to iodine molecules.
B Oxidation number of iodine increases from 0 to +1.
C Electron flows from electrode Y to electrode X through the external circuit
D Oxidation number of chromium decreases from +6 to +2

[MRSM03-49]

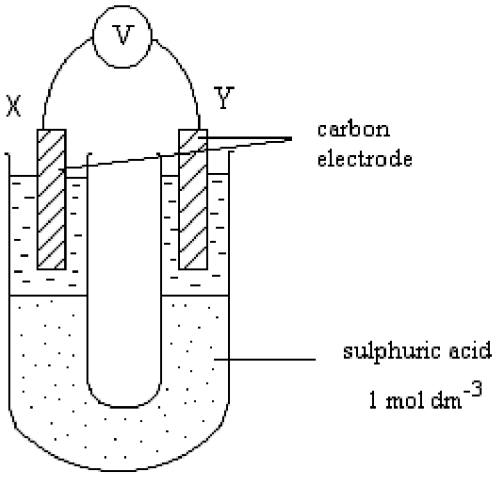


Figure 15

Which of the following pairs of reactants caused electron flow from X to Y through the external circuit in Figure 15?

	X	Y
I	KI(aq)	$KMnO_4$ (aq)
II	KBr (aq)	Cl_2 (aq)
III	$KMnO_4$ (aq)	KBr (aq)
IV	$K_2Cr_2O_7$ (aq)	$FeSO_4$ (aq)

A I and II only
B II and III only
C I and IV only
D II, III and IV only

[MRSM05–47] The following ionic equation shows the reaction between iron(II) sulphate solution and acidified potassium dichromate(VI) solution.

$$\mathbf{Cr_2O_7^{2-} + 14\ H^+ + 6\ Fe^{2+} \text{ -- > } 2\ Cr^{3+} + 6\ Fe^{3+} + 7\ H_2O}$$

Which of the following statements are true about this reaction?

I Orange coloured acidified potassium dichromate(VI) solution is decolourized
II Dichromate(VI) ion is reduced to chromium(III) ion
III Oxidation number of iron increased from +2 to +3
IV Electrons are transferred from dichromate(VI) ions to iron(II) ions

A I and II only
B II and III only
C I , II and III only
D II , III and IV only

[MRSM07-48] Diagram 19 shows the set-up of apparatus used to study the transfer of electrons at a distance.

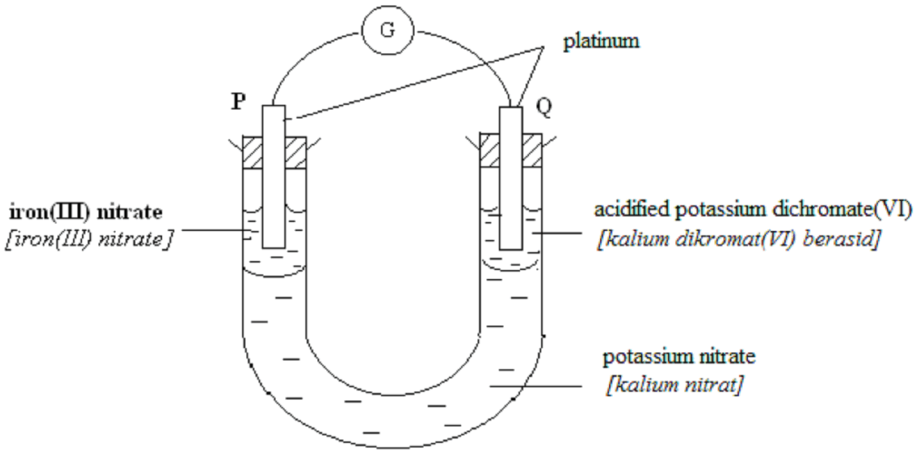


DIAGRAM 19

After a few hours, there is no deflection of the galvanometer's needle. This is because

A both electrolytes are oxidising agent
B aqueous potassium nitrate is used as salt bridge
C no supply of electric current
D platinum electrode used

[MRSM07-35] Reaction between Fe^{2+} ions and MnO4^{-} ions is represented by the following equation.

$$\mathbf{5\ Fe^{2+} + MnO_4^- + 8\ H^+ \text{ -- > } 5\ Fe^{3+} + Mn^{2+} + 4\ H_2O}$$

Which of the following information could be obtained from the equation?

I The oxidation number of manganese changes from +7 into +2
II The oxidation number of hydrogen changes from +1 into 0
III The green colour of Fe^{2+} ions solution turn to brown
IV Electrons transfer from Fe^{2+} ions into MnO_4^- ions solution

A I and III only
B II and IV only
C I, II and III only
D I, III and IV only

[MRSM07-36] Redox reaction between iron(II) ion and manganate(VII) ion is represented by the equation:

$$5\ Fe^{2+} + MnO_4^- + 8\ H^+ \rightarrow 5\ Fe^{3+} + Mn^{2+} + 4\ H_2O$$

What can be deduced from the equation?

I The oxidation state of manganese changes from +7 into +2
II The oxidation state of hydrogen changes from +1 into 0
III The greenish colour of iron(II) ions solution turns to colourless
IV Electrons transfer from iron(II) ions to manganate(VII) ions

A I and III only
B I and IV only
C I, II and III only
D I, II, III and IV

[MRSM09-33] Diagram 14 shows an apparatus set up to study a redox reaction.

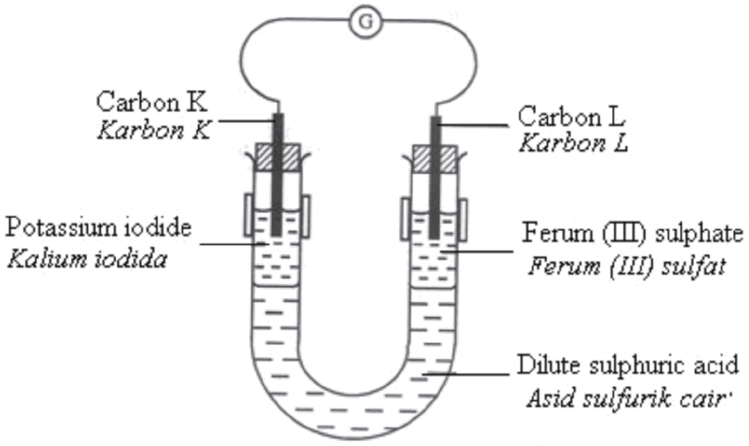


Diagram 14

What is observed at the carbon K and carbon L?

	Carbon K	Carbon L
A	Brown to colourless	Green to brown
B	Brown to colourless	Colourless to yellow
C	Colourless to brown	Green to brown
D	Colourless to brown	Brown to green

[SPM08-32] Diagram 5 shows the apparatus set-up used to investigate the reaction of acidified potassium manganate (VII) with iron (II) sulphate solution.

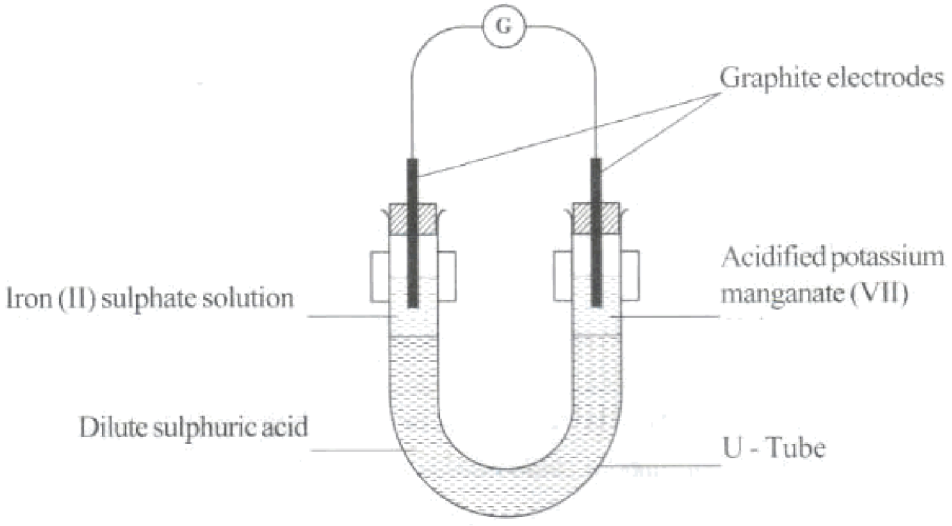


Diagram 5

Which of the following is the colour change of the two solutions?

	Iron (II) sulphate solution	Acidified potassium manganate (VII)
A	Green to brown	Purple to colourless
B	Brown to green	Purple to colourless
C	Brown to green	Orange to green
D	Green to brown	Orange to green

[SBPTrial08-50] Diagram 18 shows the set of apparatus of an experiment to investigate electron transfer at a distance.

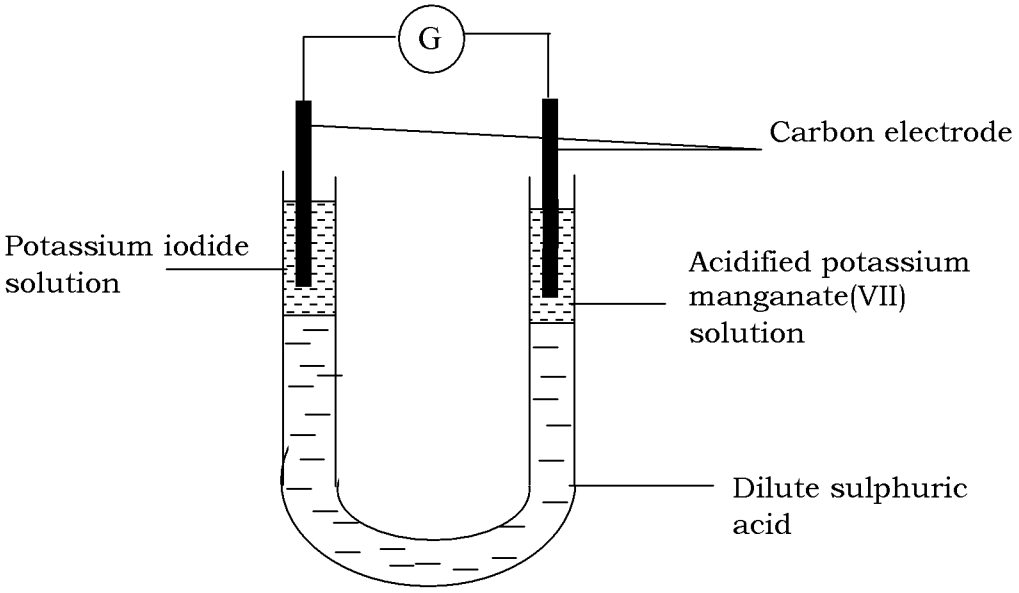


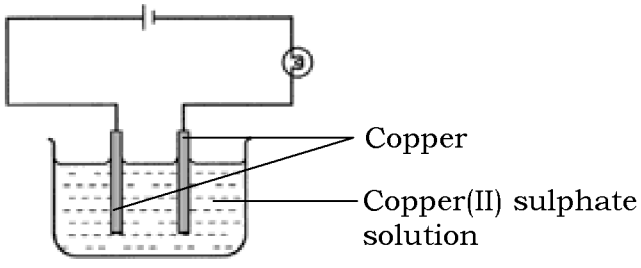
Diagram 18

Which of the following statements is true about the experiment?

A Iodide ion is the reducing agent
B Oxidation number of iodine decreases from 0 to -1
C Oxidation number of manganese increases from +2 to +7
D Electrons flow from potassium iodide solution to acidified potassium manganate(VII) through sulphuric acid

Electrolysis and Volteic Cell

[SBPTrial07-24] The diagram below shows the electrolysis process of copper(II) sulphate solution using copper as an electrode.



Which of the following substances are oxidized and reduced in this cell?

	Oxidised	Reduced
A	Hydroxide ion	Copper(II) ion
B	Hydroxide ion	Copper atom
C	Copper atom	Copper(II) ion
D	Copper atom	Hydrogen ion

[SPM07-16] Diagram 5 shows a type of chemical cell

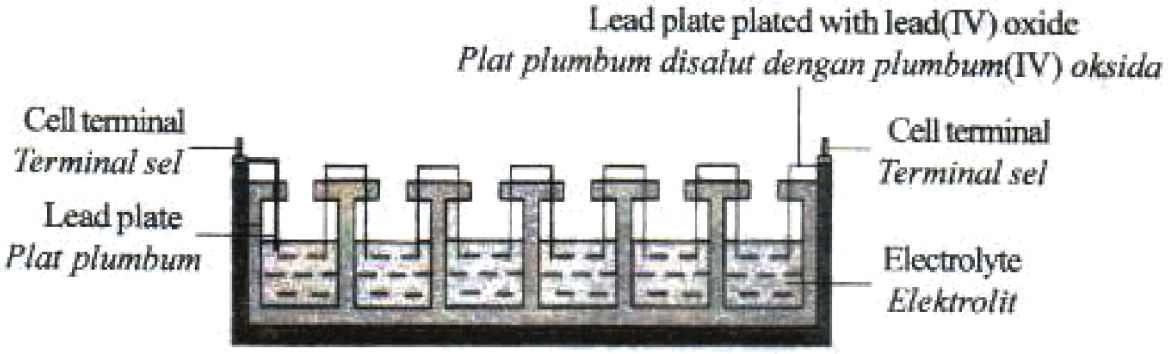


Diagram 5

Which of the following is true about the chemical cell?

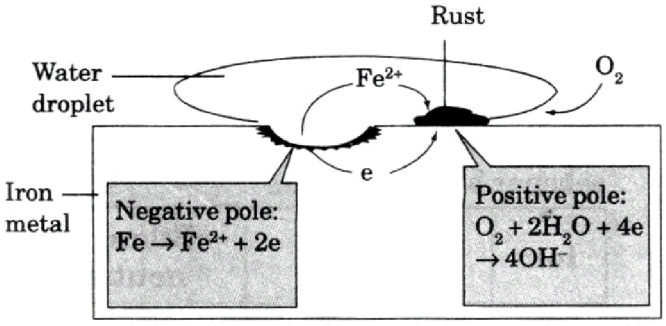
A The cell is not rechargeable
B The electrolyte used is nitric acid
C An oxidation reaction occurs at the negative terminal
D The lead plate that is plated with lead (IV) oxide is the negative terminal of the cell

Rusting

[MRSM06-19] Rusting causes a lot of financial loss. Which of the following is rust?

A Zink oxide
B Iron(II) oxide
C Iron(III) oxide
D Lead(II) oxide

[SPM05-31] the diagram shows the mechanism of rust formation.



Which of the following statements is true about this mechanism?

A an iron atom release two electrons to form an iron (II) ion
B an iron (II) ion receives two electrons from an iron atom
C an oxygen molecule receives two electrons to form a hydroxide ion
D four hydroxide ions are formed when two water molecules receive four electrons

[SPM06-18] Diagram 3 shows the rusting process of iron.

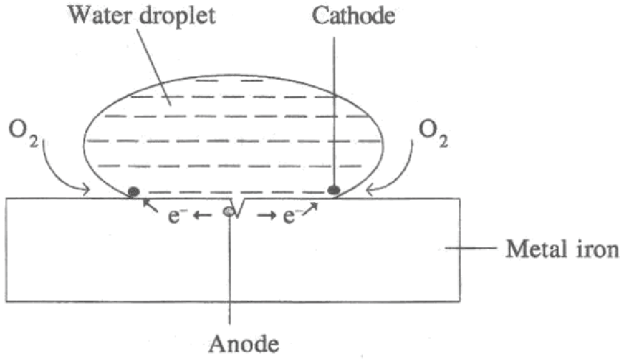
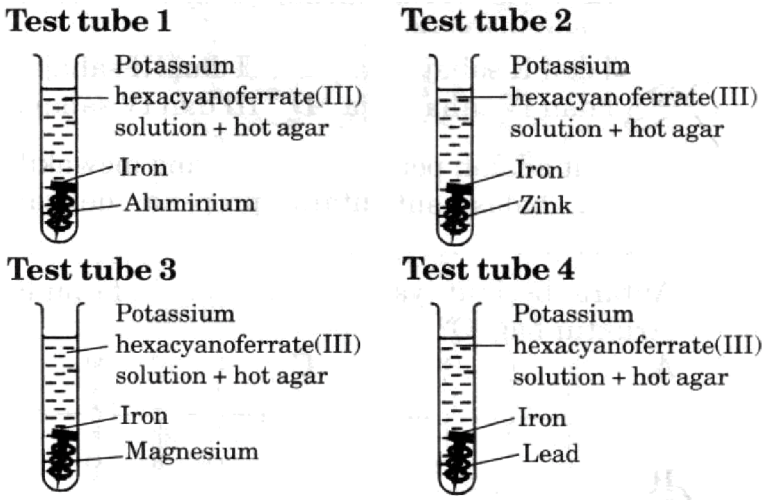


Diagram 3

Which of the following equations occurs at the cathode?

A	Fe	-- >	Fe^{2+}	+	$2e^-$			
B	Fe^{2+}	+	$2e^-$	-- >	Fe			
C	O_2	+	$2H_2O$	+	$4e^-$	-- >	$4OH^-$	
D	$4OH^-$	-- >	O_2	+	$2H_2O$	+	$4e^-$	

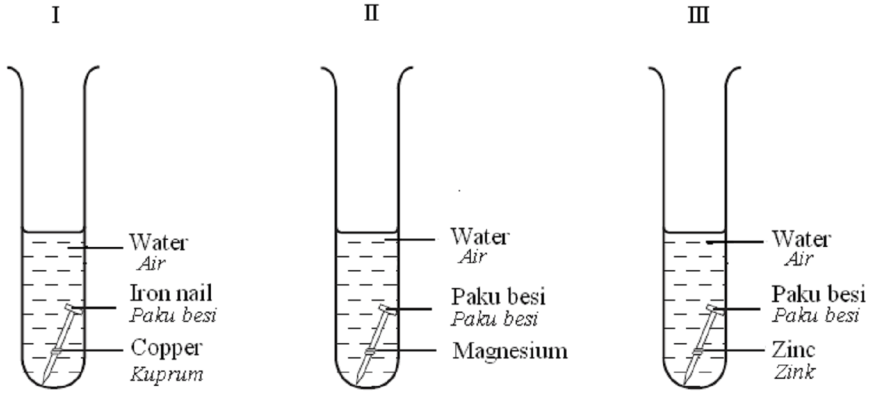
[SPM05-19] The diagram shows four pairs of metals in different test tubes.



After one day, in which test tube is the solution blue?

A test tube 1
B test tube 2
C test tube 3
D test tube 4

[MRSM07-32] Diagram 19 shows the apparatus set up used to investigate the rusting of iron.



In which test-tubes will the iron rust?

A I only
B II only
C I and III only
D II and III only

[MRSM07-32] Diagram 14 shows the set-up of apparatus to study factors affecting corrosion of iron.

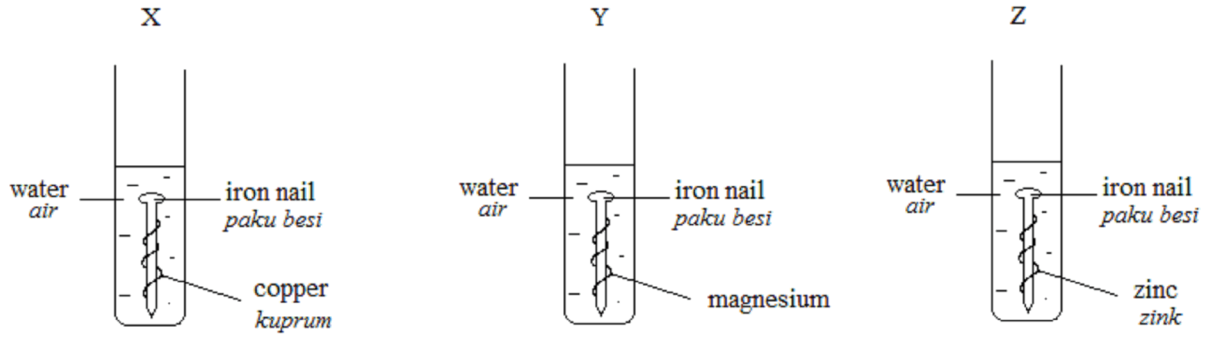


DIAGRAM 14

In which of the following test tube will the iron nail rust?

A X only
B Y only
C X and Z only
D Y and Z only

[SPM03-20] Diagram 5 shows test tubes X and Y, used in an experiment to investigate the effects of magnesium and copper on the rusting of iron.

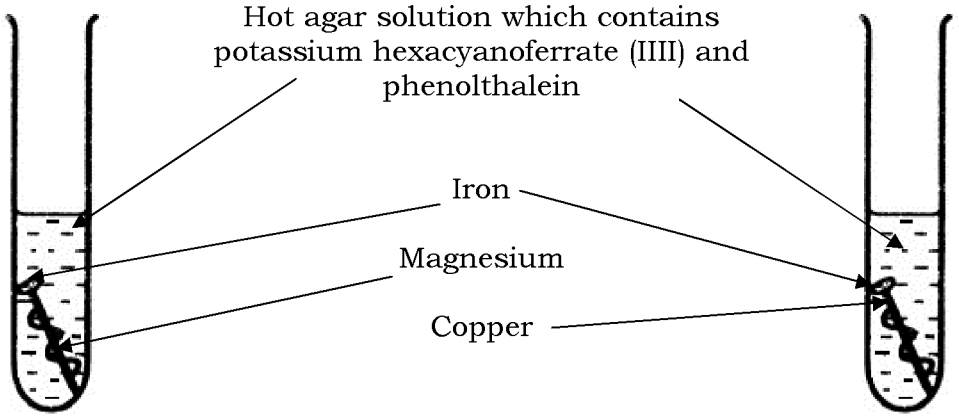


Diagram 5

Which of the following are true of the experiment?

I Phenolphthalein solution in both test tubes is to detect the presence of hydroxide ions
II The hot agar solution in both test tubes is to unsure the presence of oxygen in the mixture
III Potassium hexacyanoferrate (III) solution in test tube X is to detect the corrosion of magnesium
IV Potassium hexacyanoferrate (III) solution is test tube Y is to detect the presence of iron(II) ions

A I and IV only
B II and III only
C I, III and IV only
D I, II, III and IV

[SBPTrial08-39] Diagram 13 shows the setup of apparatus to investigate the effect of metals X, Y and Z on the rusting of iron

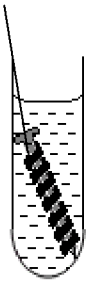
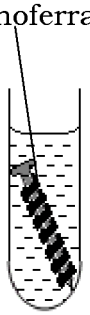
Experiment	**A**	**B**	**C**
	Hot agar solution + potassium hexacyanoferrate(III) 	Hot agar solution + potassium hexacyanoferrate(III) 	Hot agar solution + potassium hexacyanoferrate(III) 
Material	Iron nail and metal X	Iron nail and metal Y	Iron nail and metal Z
Observation	Small amount of blue spot	No change	A lot of blue spot

Diagram 13

Which of the following arrangements of metals X, Y and Z is in descending order of their electropositivity?

A X, Y, Z
B Y, X, Z
C Z, X, Y
D Y, Z, X

[SPM11-50] Iron rusts in the presence of oxygen and water. Which method causes iron to rust faster?

A Coating iron with tin
B Touching iron with lead
C Galvanizing iron with zinc
D Connecting iron to magnesium

[MRSM11-41] Diagram 15 shows the apparatus set-up to study the corrosion of an iron nail.

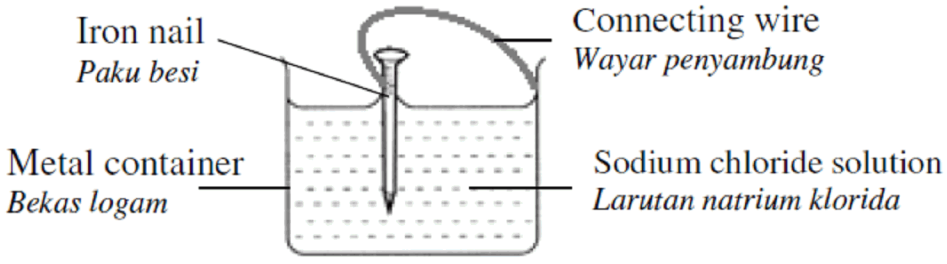


Diagram 15

Which metal container causes the iron nail to corrode the fastest?

A Magnesium
B Silver
C Lead
D Tin

[MRSM10-17] Diagram 3 shows the rusting process of an iron nail when paired with metal X.

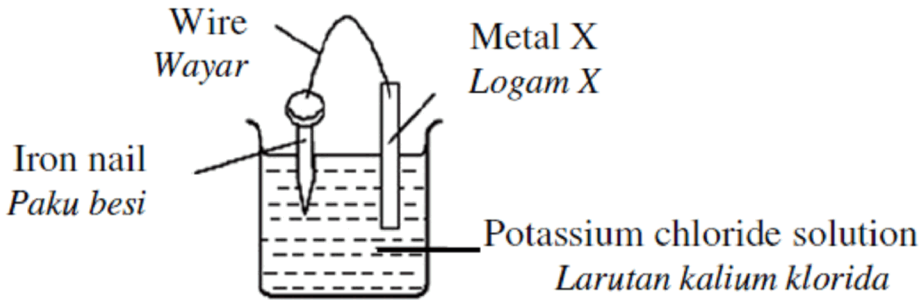


Diagram 3

The rate of rusting is the highest when X is

A zinc
B silver
C lead
D magnesium

[MRSM03-10] Figure 1 shows a set of apparatus to study the corrosion of an iron nail.

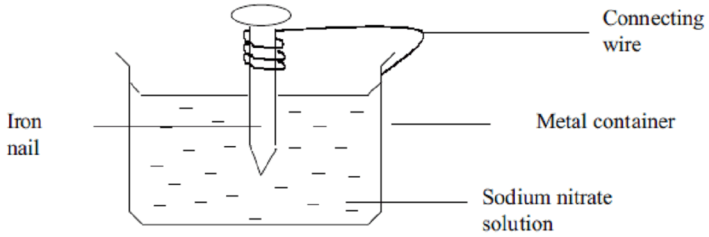


FIGURE 1

The rate of corrosion of the iron nail is fastest if the metal container is made of

A zinc
B tin
C lead
D silver

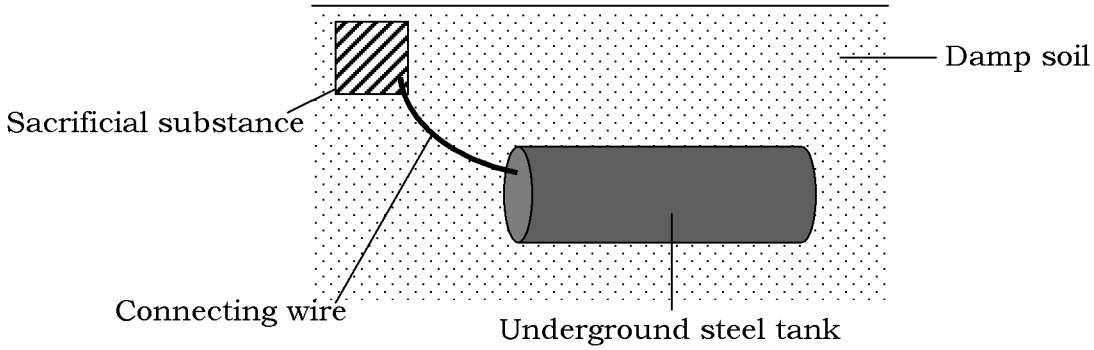
[SBPdiag06-20] The food container of the canned food does not rust easily because it has been electroplated with a layer of

A tin
B zinc
C aluminium
D magnesium

[SPM10-40] Which metal can prevent rusting when is in contact with iron?

A Lead
B Silver
C Copper
D Magnesium

[SBPTrial09-50] Diagram 15 shows a method to prevent the corrosion of underground steel tank by sacrificial protection.

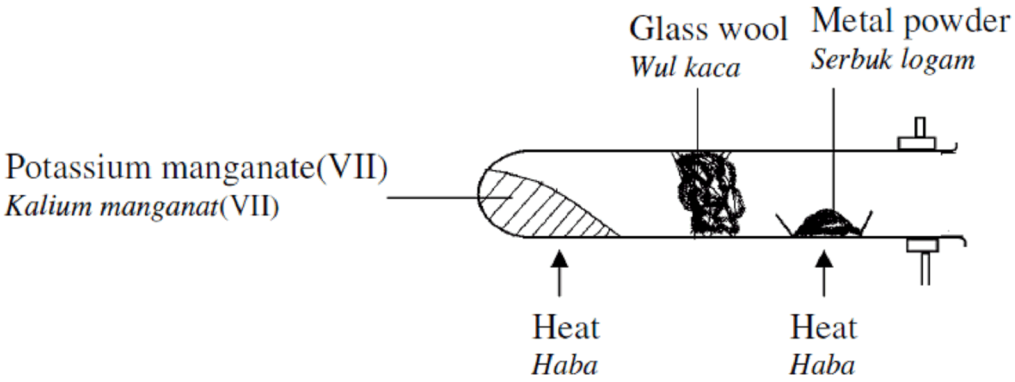


Which of the following elements is the most suitable as the sacrificial substance?

A Carbon
B Copper
C Iron
D Magnesium

Reactivity Series

[MRSM11-17] Diagram 5 shows the apparatus used to determine the position of metals in the Reactivity Series.



What is the function of potassium manganate(VII) powder in this reaction?

A To increase the amount of heat
B To catalyse the reaction
C To react with metal
D To supply oxygen

[MRSM10-33] The following equation shows the reaction between copper(II) oxide and carbon.

$$2\ CuO + C \rightarrow CO_2 + 2Cu$$

Which of the following statements is true about the reaction?

A Carbon is an oxidising agent
B Copper(II) oxide is a reducing agent
C Carbon is reduced to carbon dioxide
D Copper(II) oxide is reduced to copper.

[SPM08-31] The following equation shows the reaction between carbon and zinc oxide.

$$C + 2\,ZnO \text{ -- > } CO_2 + 2\,Zn$$

Which statement is true about this reaction?

A Zinc oxide is oxidized to zinc
B Carbon is the reducing agent
C The oxidation number of carbon decreases
D The oxidation number of oxygen increases

[SPM07-18] What is the position of hydrogen in the reactivity series of metals?

A Between zinc and iron
B Between aluminium and zinc
C Between lead and copper
D Between iron and lead

[MRSM07-15] Diagram 6 shows the apparatus set up used to study the reaction of metal oxide and carbon.

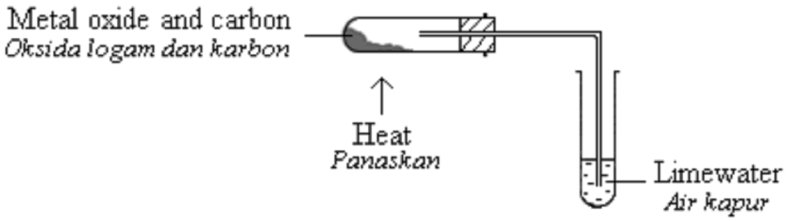


Diagram 6

Which of the following metal oxide will turn the lime water cloudy?

A Magnesium oxide
B Copper(II) oxide
C Calcium oxide
D Aluminium oxide

[MRSM07-17] Diagram 7 shows a set up where hydrogen is passed over a heated metal oxide.

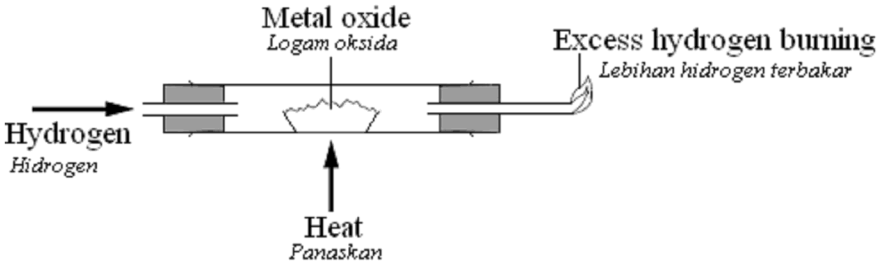


Diagram 7

What happens to the hydrogen and metal oxide?

	Hydrogen	Metal oxide
A	Oxidised	Oxidised
B	Reduced	Oxidised
C	Reduced	Reduced
D	Oxidised	Reduced

[MRSM07-47] Powdered carbon and copper are separately heated as shown in Diagram 25

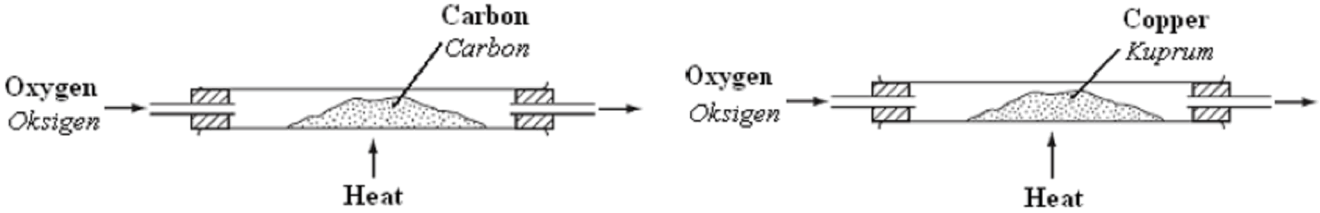


Diagram 25

What are the changes in the masses of the powder?

	Carbon	Copper
A	Decrease	Decrease
B	Decrease	Increase
C	Increase	Decrease
D	Increase	Increase

[SBPtrial11-23] Diagram 9 shows the apparatus set up to determine the position of carbon in the Reactivity Series of Metals..

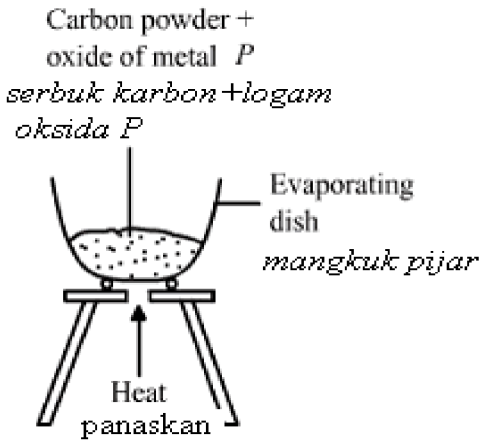


Diagram 9

Excess carbon powder is mixed thoroughly with the powder oxide of metal *P* and then heated strongly. The experiment is repeated with oxides of metals *Q* and *R*. The following observations are obtained ,

Mixture	Observation
Carbon + *P* metal oxide	Burns brightly, grey powder is formed
Carbon + *Q* metal oxide	Glows faintly, grey powder is formed
Carbon + *R* metal oxide	No change

The position of carbon with respect to the metals P, Q and R in the reactivity series of metal in **descending order** is

A P, Q, R, Carbon
B P, Q, Carbon, R
C Carbon, R, Q, P
D R, Carbon, Q, P

[MRSM04-31] Figure 10 shows the apparatus set – up for the reaction between oxide T and mixture U.

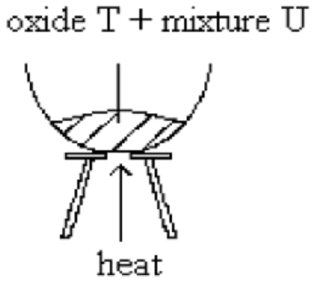


FIGURE 10

Which of the following pairs will react when heated strongly?

	Mixture U	Oxide T
A	Aluminium powder + carbon powder.	Magnesium oxide
B	Iron powder + tin powder.	Zinc oxide
C	Carbon powder + copper powder.	Lead(II) oxide
D	Tin powder + copper powder.	Aluminium oxide

[MRSM06-35] The table shows the observations of an experiment involving heating of two substances.

Substances	Observation
Carbon powder and metal P oxide	Glow
Hydrogen gas and metal Q oxide	Glow
Hydrogen gas and metal P oxide	No changes

Which of the following is in ascending order for the reactivity of elements towards oxygen?

A Carbon, P, hydrogen, Q
B Q, hydrogen, P, carbon
C Hydrogen, P, carbon, Q
D Hydrogen, Q, carbon, P

[MRSM09-48] Table 7 shows the observation obtained when a mixture of two substances was heated strongly.

Mixture	Observation
Carbon powder and metal P oxide	Mixture glows
Hydrogen gas and metal Q oxide	Mixture glows
Hydrogen gas and metal P oxide	No change

Table 7

Arrange elements P, Q, carbon and hydrogen in ascending order of reactivity towards oxygen.

A Carbon, P, hydrogen, Q
B Q, hydrogen, P, carbon
C Hydrogen, P, carbon, Q
D Hydrogen, Q, carbon, P

[SPM06-19] Diagram 4 shows the extraction process of iron in a blast furnace.

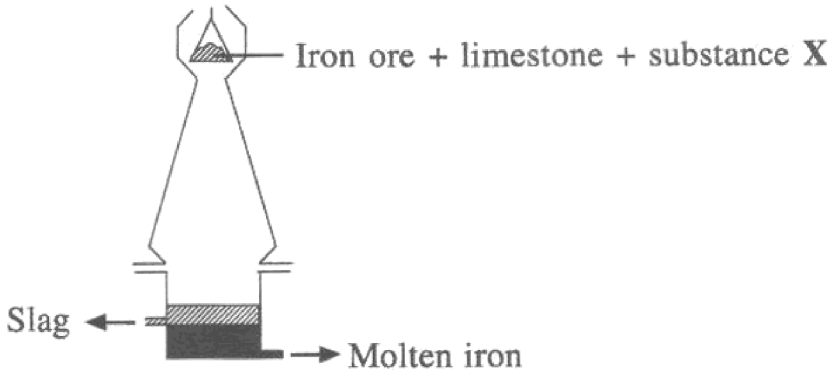


Diagram 4

What is substance **X**?

A Silver
B Aluminium
C Coke
D Vanadium(V) oxide

[SPM05-32] When powder of metal P is heated with black metal Q oxide, the following observations are made:

- **a glow is seen**
- **the residue produced is yellow when it is hot and white when it is cold**

Based on the information above, which statements is true?

A the powder of metal Q can displace P from its salt solution
B metal Q oxide can react with a heated carbon powder
C metal P oxide can react with a heated iron powder
D the powder of metal P can react with a heated magnesium oxide powder

[SPM10-10] Metal X has the following properties.

- Less reactive than iron.
- Does not react with iron(II) oxide

Which metal oxide can react with X?

A Zinc oxide
B Magnesium oxide
C Copper(II) oxide
D Aluminium oxide

Redox Mix

[SPM04-15] Which of the following is a redox reaction?

A Displacement
B Esterification
C Neutralization
D Double decomposition

[MRSM10-16] Which of the following chemical reactions is a redox reaction?

A Displacement
B Neutralisation
C Hydrogenation
D Halogenation

[MRSM03-16] Which of the following are redox reactions?

I Corrosion of iron
II Displacement of copper(II) sulphate by zinc
III Electrolysis of dilute potassium bromide solution
IV Neutralization of hydrochloric acid with sodium hydroxide

A I and II only
B III and IV only
C I, II and III only
D I, II, III and IV

[SBPTrial09-38] Which of the following equations represent a redox reaction?

I $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$
II $2HCl + Zn \rightarrow ZnCl_2 + H_2$
III $Ag^+ + Cl^- \rightarrow AgCl$
IV $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$

A I and II
B II and IV
C I and III
D III and IV

[MRSM03-50] Which of the following chemical equations represent redox reactions?

I $Na_2S_2O_3 + 2HCl \text{ -- > } 2NaCl + S + S0_2 + H_20$
II $CuCO_3 + H_2SO_4 \text{ -- > } CuSO_4 + C0_2 + H_20$
III $Pb(N0_3)_2 + 2KI \text{ -- > } PbI_2 + 2KN0_3$
IV $N_2 + 3H_2 \text{ -- > } 2NH_3$

A I and III only
B I and IV only
C II, III and IV only
D I, II, III and IV

[SPM04-32] Which of the following reactions shows that copper is oxidised?

A Reaction of zinc with copper (II) oxide
B reaction of copper with silver nitrate solution
C electrolysis of copper (II) sulphate solution by using carbon electrodes
D chemical cell with copper and zinc electrodes in dilute sulphuric acid

[MRSM04-18] Which of the underlined substances in the following equations undergo oxidation?

I $2\underline{Na} + Cl_2 \text{ -- > } 2NaCl$
II $KOH + H\underline{Cl} \text{ -- > } KCl + H_2O$
III $\underline{Mg} + CuSO_4 \text{ -- > } MgSO_4 + Cu$
IV $Pb(NO3)_2 + 2K\underline{I} \text{ -- > } PbI_2 + 2KNO_3$

A I and III only
B II and III only
C I, II and IV only
D I, III and IV only

[SPM09-11] Which of the following is an oxidizing agent?

A Chlorine
B sulphur dioxide
C hydrogen sulphide
D Potassium bromide

[MRSM11-16] Which of the following substances is a reducing agent?

A Acidified potassium manganate(VII)
B Potassium iodide
C Iron(III) sulphate
D Chlorine

[SBPTrial07-11]

- Bromine water
- Acidified potassium manganate(VII)
- Acidified potassium dichromate(VI)

Which of the following is true about the substances?

A Reducing agent
B Oxidising agent
C Dehydration agent
D Hydration agent

[SPM03-19] Which of the following are oxidizing agents?

I Zinc
II Bromine water
III Potassium iodide solution
IV Acidified potassium manganate (VII) solution

A I and III only
B II and IV only
C I, II and III only
D I, II and IV only

[SPM05-06] Gas X is passed into an acidic dichromate solution. The colour of the solution changes from orange to green. What is gas X?

A sulphur dioxide
B hydrogen chloride
C nitrogen dioxide
D chloride

[SPM05-44] 0.12 g of magnesium reacts with excess hydrochloric acid to produce hydrogen gas. [Relative atomic mass: H=1, Mg=24, Cl=35.5, 1 mol of gas occupies 24 dm^3 at room temperature and pressure]

Which of the following is true about the reaction?

I $Mg + 2H^+ \longrightarrow Mg^{2+} + H_2$
II volume of gas released is 120 cm^3
III mass of the salt formed is 0.30 g
IV this is a redox reaction

A I and II only
B I and III only
C I, II and IV only
D II, III and IV only

[SPM08-37] Which of the following is **not** a redox reaction?

A $2Fe + 3Cl_2 \longrightarrow 2FeCl_3$
B $4FeO + O_2 \longrightarrow 2Fe_2O_3$
C $FeCl_2 + Mg \longrightarrow MgCl_2 + Fe$
D $FeSO_4 + 2NaOH \longrightarrow Fe(OH)_2 + Na_2SO_4$

[SBPTrial07-49] Which of the following equations represents a redox reaction?

A $Pb(NO_3)_{2(aq)} + CuSO_{4(aq)} \text{ -- > } PbSO_{4(s)} + Cu(NO_3)_{2(aq)}$
B $CH_3COOH_{(aq)} + NaOH_{(aq)} \text{ -- > } CH_3COOH_{(aq)} + H_2O_{(l)}$
C $Mg_{(s)} + CuSO_{4(aq)} \text{ -- > } MgSO_{4(aq)} + Cu_{(s)}$
D $C_2H_{4(g)} + 3O_{2(g)} \text{ -- > } 2CO_{2(g)} + 2H_2O_{(l)}$

[SBPTrial08-19] Element X is a reducing agent. Which of the following electron arrangements is for atom X?

A 2.8.2
B 2.8.8
C 2.8.7
D 2.8.4

[SPM06-47] The following is a half equation is half equation for a reaction.

$$IO_3^- + qH + re^- \longrightarrow \tfrac{1}{2} I_2 + sH_2O$$

What are ***q***, **r** and **s**?

	q	**r**	**s**
A	3	5	6
B	5	3	6
C	5	6	3
D	6	5	3

Structure {Paper02}

[MRSM10-05a]

(*a*) Diagram 5.1 shows a reaction between lithium and chlorine gas.

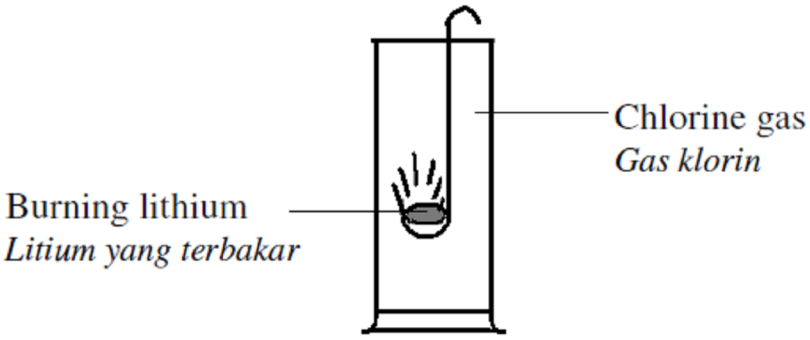


Diagram 5.1

(i) Write a chemical equation for the reaction. [1M]

.....

(ii) State the changes in oxidation number for chlorine. [1M]

.....

(iii) Explain why lithium acts as the reducing agent in terms of electron transfer. [1M]

.....

[MRSM10-05b]

(*b*) Diagram 5.2 shows the addition of bromine water into a test tube containing potassium iodide solution until in excess.

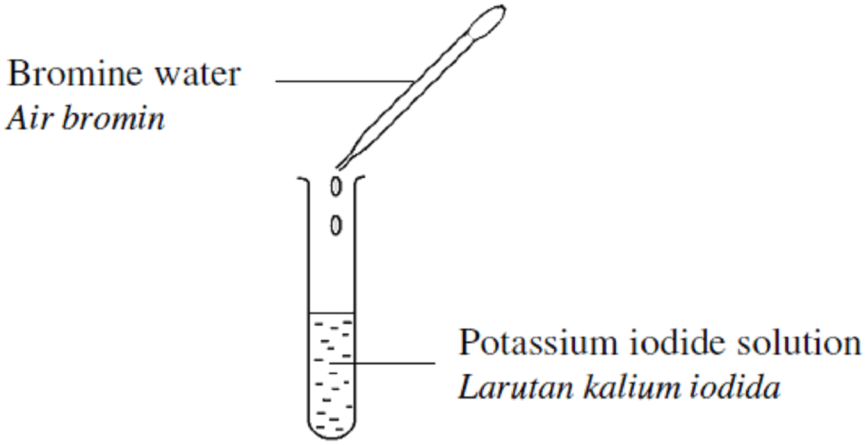


Diagram 5.2

(i) A small amount of 1,1,1-trichloroethane liquid is added to the product in the test tube and the mixture is shaken. What is the colour of 1,1,1-trichloroethane layer? [1M]

.....

(ii) Write the ionic equation for the reaction between bromine and potassium iodide solution. [1M]

.....

(iii) What is the role of bromine water in this reaction? [1M]

.....

[SBPTrial10-05]

Diagram 5 shows an experiment of displacement of halogen from its halide solution.

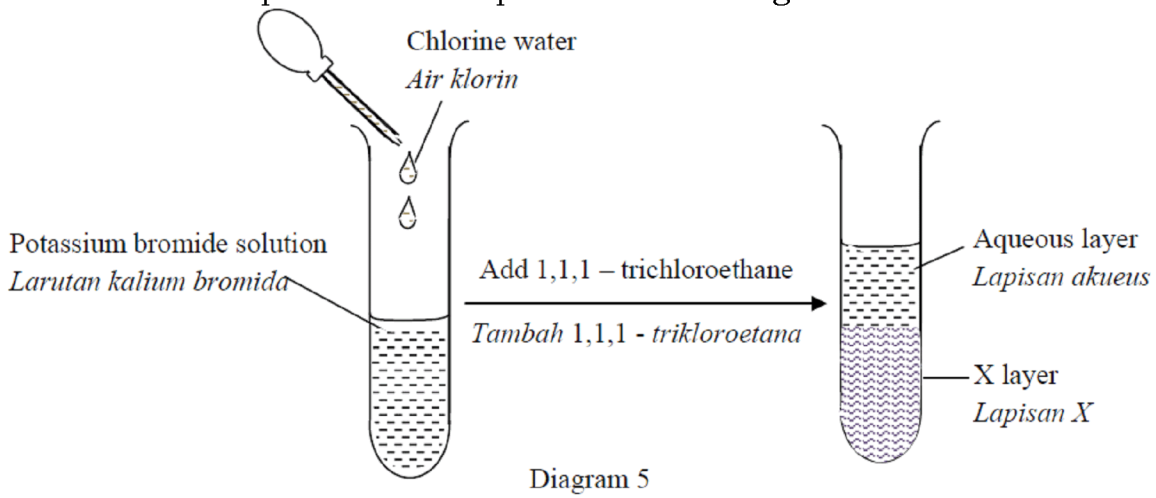


Diagram 5

(a) (i) State an observation for the reaction in the test tube before 1,1,1-trichloroethane is added [1M]

.....

(ii) State the name of the substance that is oxidized [1M]

.....

(iii)Write the oxidation reaction equation for this reaction. [2M]

.....

(b) After 1,1,1-trichloroethane is added into the test tube, state the colour of X layer [1M]

.....

(c) Name the oxidising agent for this reaction and give reason in terms of electron transfer. [2M]

.....

.....

(d) State the change of oxidation number for chlorine water. [1M]

.....

(e) State another reagent that can replace chlorine water. [1M]

.....

(f) By using suitable chemical substance and apparatus, draw a labelled diagram to show the transfer of electron at a distance. [2M]

[SPM03-05]

Diagram 5 shows the setup of apparatus to investigate the reactions that take place in test tubes P and Q.

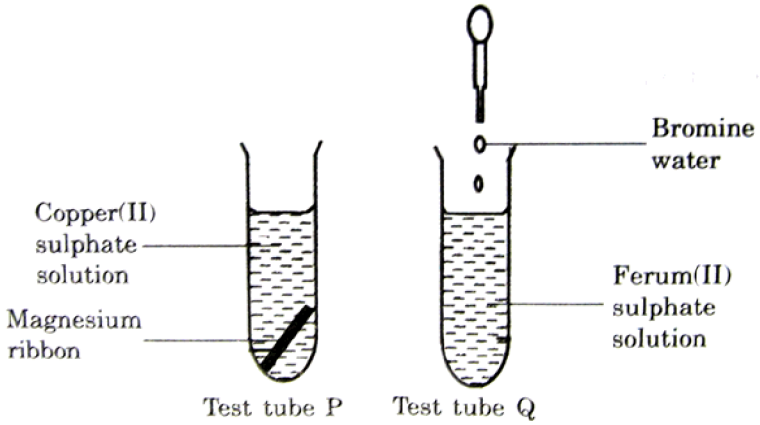


Diagram 5

(a) State the observation for the reaction

(i) is test tube P. [1M]

.....

(ii) is test tube Q. [1M]

.....

(b) Write the ionic equation for the reaction in (a)(i). [1M]

.....

(c) State what is meant by oxidizing agent in terms of electron transfer. [1M]

.....

(d) deferring to the reaction that takes place in test tube p.

(i) What is the change in the oxidation number of magnesium? [1M]

.....

(ii) State the oxidation number of bromine in bromine water. [1M]

.....

(iii) What is the function of bromine water? [1M]

.....

(iv) Name another reagent that can replace bromine water. [1M]

.....

[MRSM11-04]

Diagram 4 shows the apparatus set-up of an experiment to investigate the redox reaction between acidified potassium manganate(VII) solution and iron(II) sulphate solution.

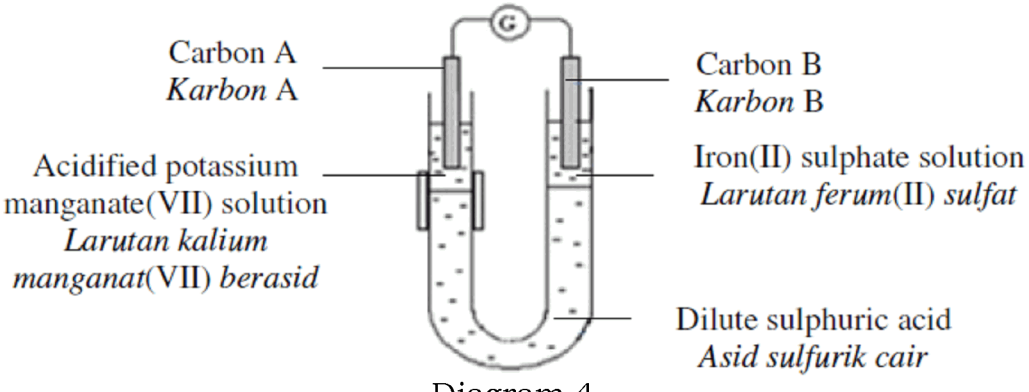


Diagram 4

(*a*) What is meant by redox reaction? [1M]

.....

.....

(*b*) Show the direction of the flow of electrons in Diagram 4. [1M]

(*c*) Calculate the oxidation number of manganese in MnO_4^- ion. [2M]

(*d*) State the type of reaction that occurs at carbon A. [1M]

.....

(*e*) Based on the reaction that takes place at carbon B :

(i) Write the chemical formula of iron(II) sulphate. [1M]

.....

(ii) State the colour change of the solution after 30 minutes. [1M]

.....

(iii) Write the half equation for the reaction. [1M]

.....

(iv) Describe a chemical test to confirm the product formed at carbon B. [2M]

.....

.....

[SPM11-06]

Diagram 6 shows the apparatus set-up for an experiment to investigate electron transfer at a distance in redox reactions.

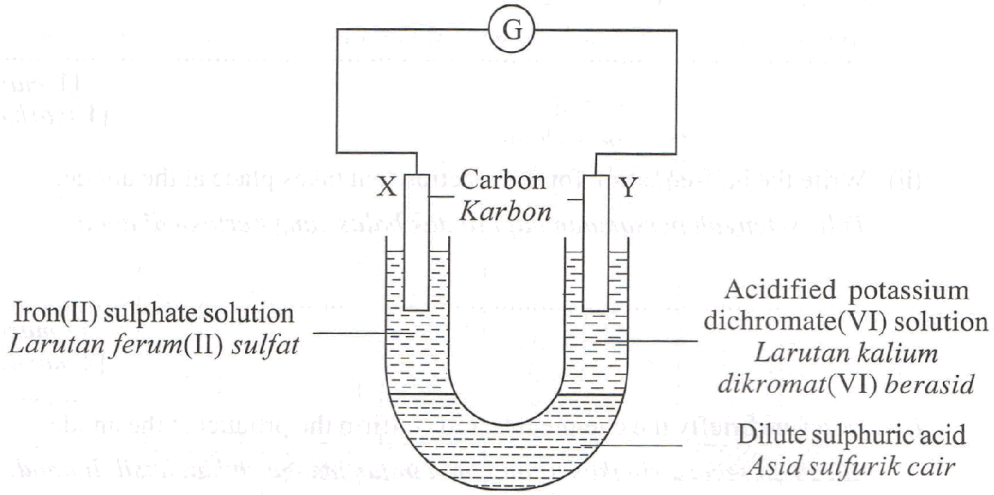


Diagram 6

(a). State the colour of iron(II) sulphate solution. [1M]

.....

(b) When the circuit is completed, the galvanometer shows a deflection.

(i). Write the half-equation for the reaction at X. [1M]

.....

(ii). State the type of reaction in 6(b)(1). [1M]

.....

(d) Table 6 shows a list of apparatus and materials.

Apparatus and Materials	
• Porous pot	• Carbon electrodes
• Beaker	• Bromine water
• Connecting wires	• Potassium iodide solution
• Galvanometer	

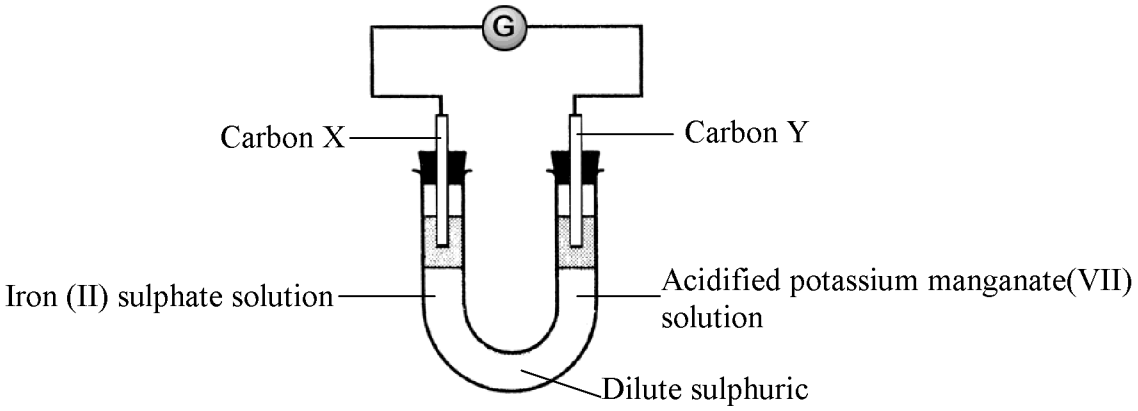
Table 6

Draw one labelled diagram to show the apparatus set-up to investigate electron transfer at a distance. The diagram must include the apparatus and materials given in Table 6.

Mark in the diagram the positive and negative terminals of the cell. [3M]

[SBPtrial09-06]

(a) Diagram 6.1 shows the apparatus set-up of an experiment to investigate the transfer of electrons at a distance.



(i) State the name of the oxidizing agent in this reaction. [1M]

.....

(ii) Referring to the reaction that takes place at carbon X:

Write the half equation for the reaction. [1M]

.....

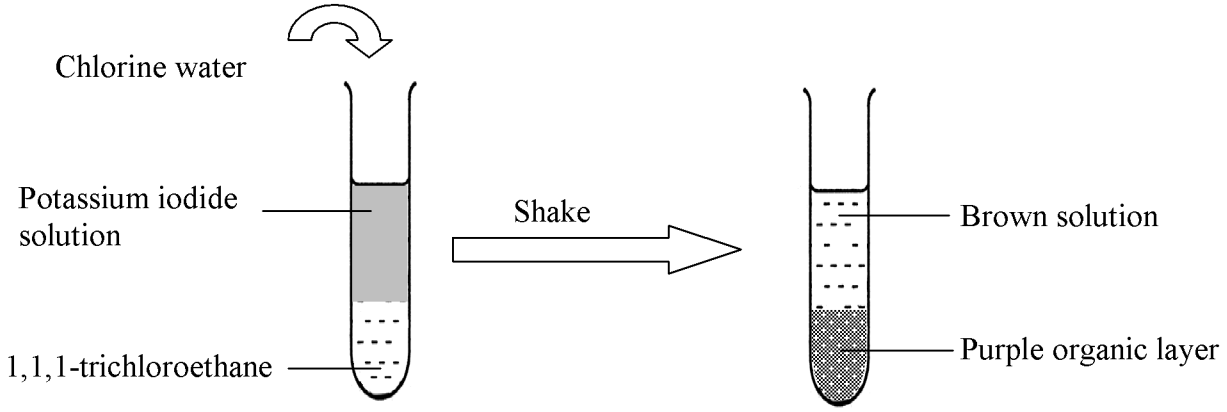
(iii) State one observation that occurred. [1M]

.....

(iv) Show the direction of the electron flow in Diagram 6.1. [1M]

(v) Referring to the reaction that takes place at carbon Y, calculate the oxidation number of manganese in MnO_4^-. [2M]

(b)Diagram 6.2 shows the apparatus set-up to investigate the displacement of halogen from its halide solution. Chlorine water was added to a test tube containing a potassium iodide solution and organic solvent, 1,1,1-trichloroethane.



(i) Write the ionic equation for the reaction. [1M]

.....

(ii) What is the function of chlorine water? [1M]

.....

(iii) State the change of oxidation number for iodine. [1M]

.....

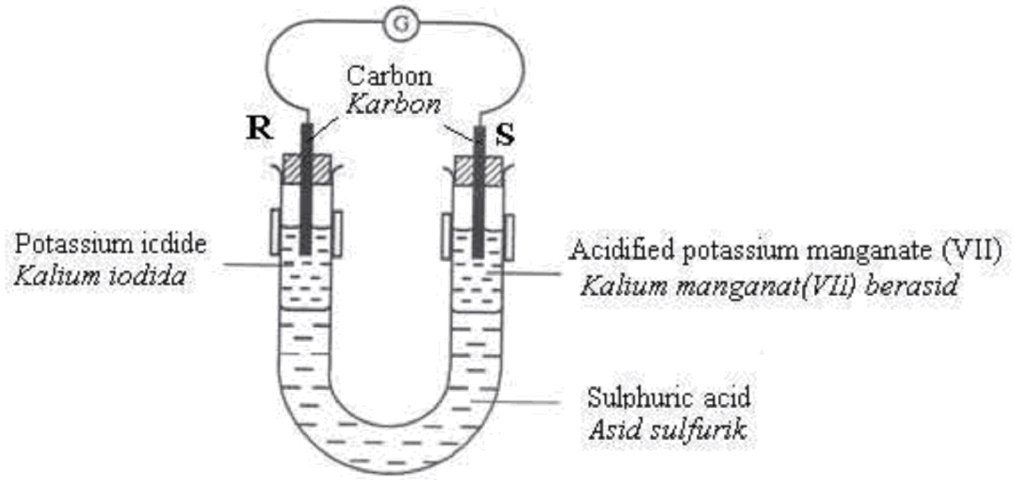
(iv) State the name of another reagent that can replace chlorine water. [1M]

.....

[MRSM09-06]

(*a*) Diagram 6.1 shows the apparatus set up to investigate the transfer of electrons at a distance between potassium iodide solution and acidified potassium manganate(VII) solution.

After a few minutes, colourless solution turns brown at electrode R.



(i) Name the product formed at electrode R. [1M]

.....

(ii) Complete the half equation for the reaction at electrode S. [1M]

$$MnO_4^- + \ldots\ldots H^+ + \ldots\ldots e \rightarrow Mn^{2+} + \ldots\ldots H_2O$$

(iii) State the change in oxidation number of manganese and name the process that occurs at S. [2M]

Change in oxidation number : .....

Name of process : .....

(iv) Suggest a substance that can replace potassium iodide solution in order to obtain the same reaction. [1M]

.....

(*b*) Diagram 6.2 shows the setup of the apparatus to investigate the reactivity of metals J, K and L. The different metals are heated consecutively.

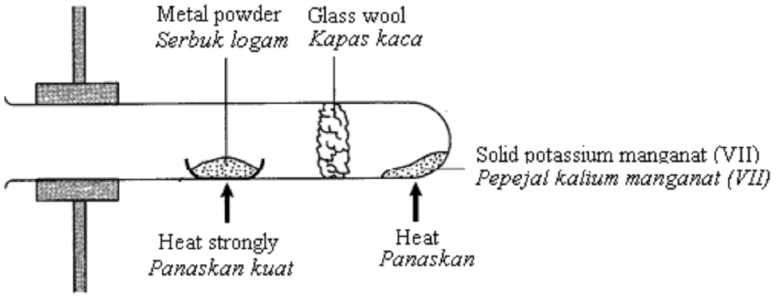


Table 6.1 shows the observation of the experiment.

Metal	Observations	Colour of residue	
		Hot	Cold
J	Burns brightly	Yellow	White
K	Glows dimly	Black	Black
L	Burns with a very bright flame	White	White

Table 6.1

(i) Name metal J. [1M]

.....

(ii) Write a chemical equation for the reaction between metal J and oxygen. [1M]

.....

(iii) Based on the observation in Table 6.1, arrange metals J, K and L in ascending order of reactivity towards oxygen. [1M]

.....

iv) A mixture of metal J and oxide of metal L is heated strongly.
Predict an observation and explain your answer. [2M]

.....

.....

[MRSM06-05]

Diagram 5 shows the apparatus set-up for a reaction involving the transfer of electron at a distance between potassium iodide solution and bromine water.

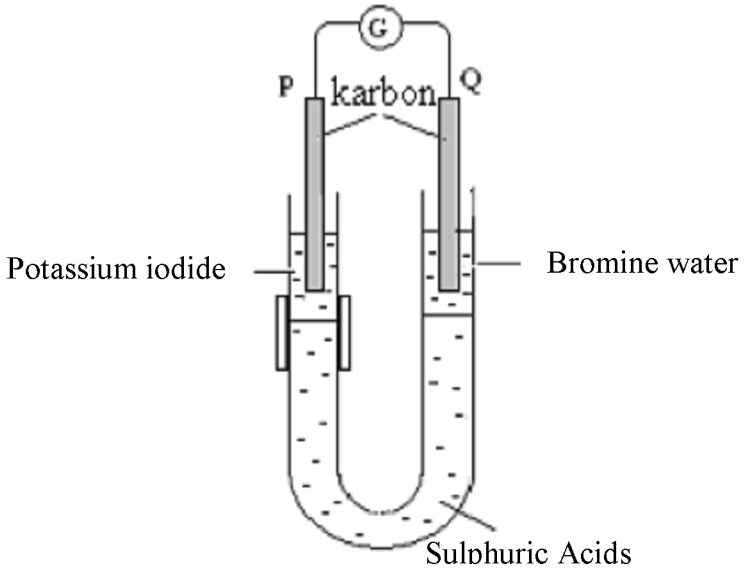


Diagram 5

Referring to the above reaction, answer the following questions:

(a) State the colour of bromine water. [1M]

.....

(b) Name the substance that is oxidised in the reaction. [1M]

.....

(c) State the direction of the flow of electrons. [1M]

.....

(d) State the change in oxidation number for

(i) iodine. : ..... [1M]

(ii) bromine : ..... [1M]

(e) Write the overall ionic equation for the reaction. [1M]

.....

(f) A brown solution is formed around electrode P.

(i) Explain briefly how you verify its identity. [2M]

.....

.....

(ii) Explain how the solution is produced. [2M]

.....

.....

.....

(g) What can be observed on the reading of the galvanometer if the bromine water at Q is replaced with chlorine water? [1M]

.....

[MRSM05-06]

Diagram 6 shows the set- up of apparatus to investigate the reactions that occur in cell A and cell B

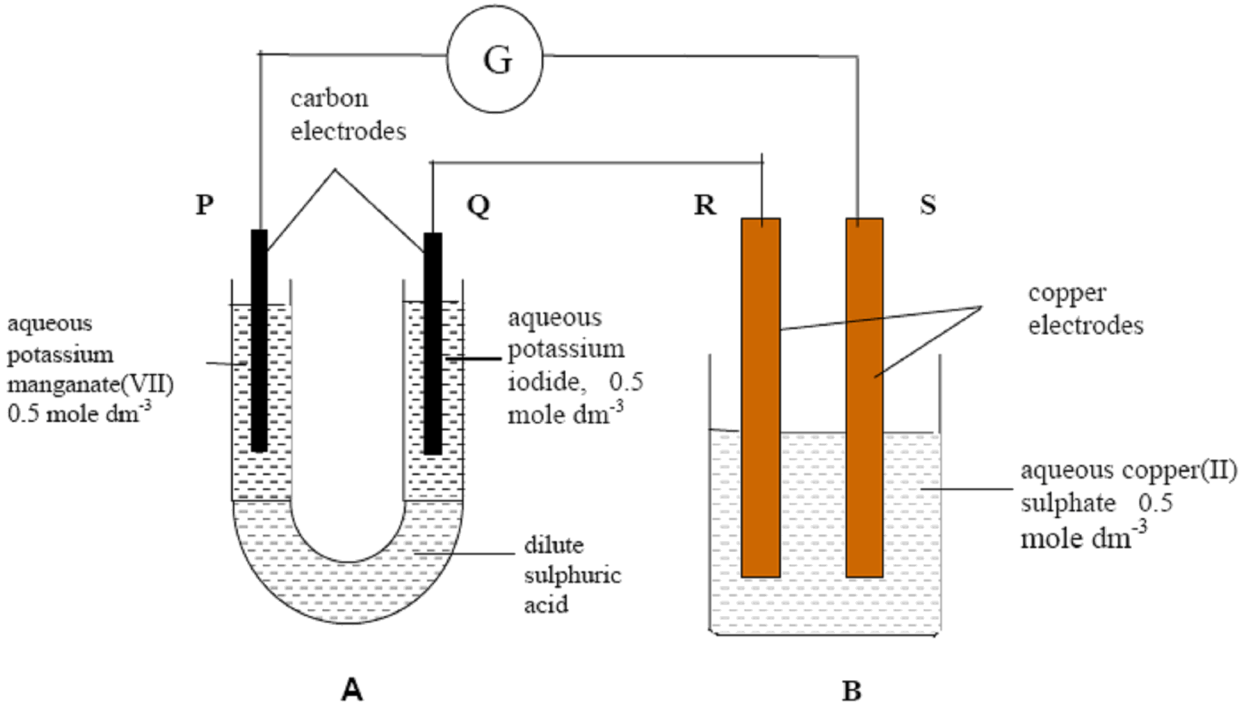


Diagram 6

(a) Half-cell reaction in cell A is represented by a half-equation,

$$MnO_4^- + 8H^+ + 5e + Mn^{2+} + 4H_2O$$

(i) State the energy change that occurs in cell A. [1M]

.....

(ii) State **one** observation at Q electrode. [1M]

.....

.....

(iii) Write the half equation for the reaction at Q electrode. [1M]

.....

(b) Referring to cell B;

(i) State one observation at R electrode. [1M]

.....

(ii) What was observed in the change of intensity of blue aqueous copper(II) sulphate? Explain your answer. [2M]

.....

.....

.....

(iii) Write the overall equation for the reaction in cell B [1M]

.....

(c) On Diagram 6, mark the direction of electron flow between cells A and B.[1M]

(d) (i) What would be observed on the reading of the galvanometer if the experiment is repeated by replacing dilute sulphuric acid in cell A with etrachloromethane? [1M]

.....

(ii) Give your reason for the answer given in d(i) [1M]

.....

(e) If copper electrodes R and S were replaced with carbon (graphite) electrodes, what could be observed at S electrode? [1M]

.....

[MRSM10-05c]

(c) Diagram 5.3 shows the set-up of apparatus for an experiment to compare the reactivity of reactions between metal oxides and hydrogen gas.

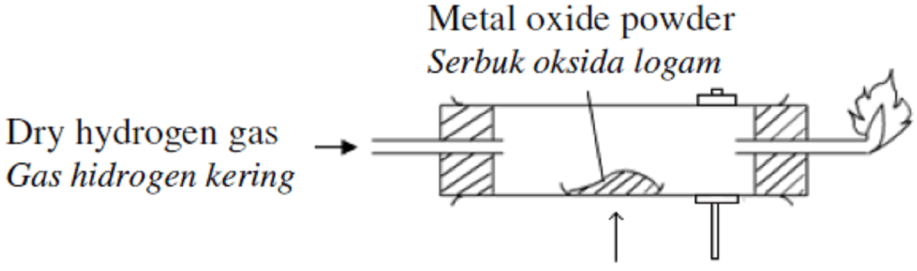


Table 5 shows the result of the experiment:

Experiment	Result
Hydrogen + oxide of metal J	Metal oxide powder glows brightly. Black powder turned brown.
Hydrogen + oxide of metal T	No reaction. Powder turns yellow when hot and white when cold.
Hydrogen + magnesium oxide	No reaction. White powder remained.

(i) Suggest a name for metal T. [1M]

.....

(ii) Arrange the reactivity of J, T, Magnesium and Hydrogen in ascending order. [1M]

.....

(iii) Based on the observations, explain how you obtain the arrangement in (*c*)(ii). [3M]

.....

.....

.....

.....

.....

[MRSM05-03]

Diagram 4 shows the set- up of apparatus for the Thermit reaction between aluminium and iron (III) oxide to produce iron metal and aluminium oxide.

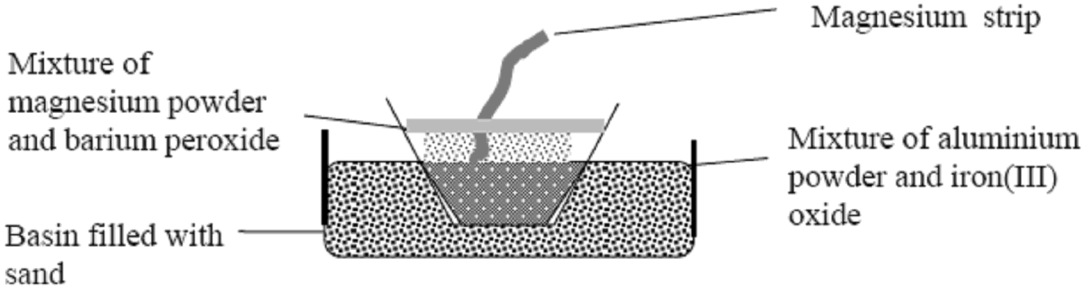


Diagram 4

Based on this Thermit reaction,

(a) Name the types of reaction that occurs. [1M]

.....

(b) (i) State the function of aluminium powder. [1M]

.....

(ii) Explain your answer in b(i) [1M]

.....

(c) (i) Write the chemical equation for the reaction between aluminium and iron(III) oxide. [1M]

.....

(ii) Calculate the maximum mass of iron produced if 4.0 g of iron(III) oxide react with excess aluminium powder. [3M]
[Relative atomic mass: Fe=56, Al=27, O=16]

(d) In industry, iron is extracted from its ore using carbon or hydrogen gas.

(i) Give **one** reason why Thermit reaction is not used in industry for the extraction of iron from its ore. [1M]

.....

(ii) Explain why carbon **or** hydrogen is suitable to be used extensively for the extraction of iron in industry. [2M]

.....

.....

[SPM05-06]

Table 6 shows the descriptions and observations for two experiments, I and II.

Experiment	Description	Observation
I	Electrolysis of 1 mol dm^{-1} Sodium sulphate solution using carbon electrodes.	Gas bubbles are released at the anode and cathode
II	Combustion of 1.2g of magnesium powder in excess oxygen.	Glaring white flame is seen and white powder is formed

(a) Based on Experiment I:
(i) Draw the setup of the apparatus to carry out this experiment.
In your diagram show how the products at the anode and cathode are collected. [3 M]

(ii) State how you would verify that the gas released at the cathode is hydrogen. [1M]

.....

(iii) Explain how hydrogen gas is produced at the cathode. [3M]

.....

.....

.....

(b) Based on Experiment II:

(i) The white powder formed is magnesium oxide.
Write the formula for magnesium oxide. [1M]

.....

(ii) Write the chemical equation for the reaction that takes places. [1M]

.....

(iii) State the oxidation number for each of the elements in magnesium oxide. [1M]

.....

[SPM07-06]

Iron is metal that rust easily.

(a)(i) State the condition for the rusting of iron.[1M]

.....

(ii)Draw a labelled diagram to show the conditions for the rusting of iron involve the ionization of iron and the flow of electron. [3 M]

(b)(i) Describe the reactions that take place at the edge of water droplet (positive terminal) during the rusting of iron after the Fe^{2+} and OH^- ions are formed. [3M]

.....

.....

.....

.....

(ii)State the change in the oxidation number of iron in 6(b)(i). [1 M]

.....

(c) Diagram 6 shows the use of zinc plates on an iron ship to prevent rusting.

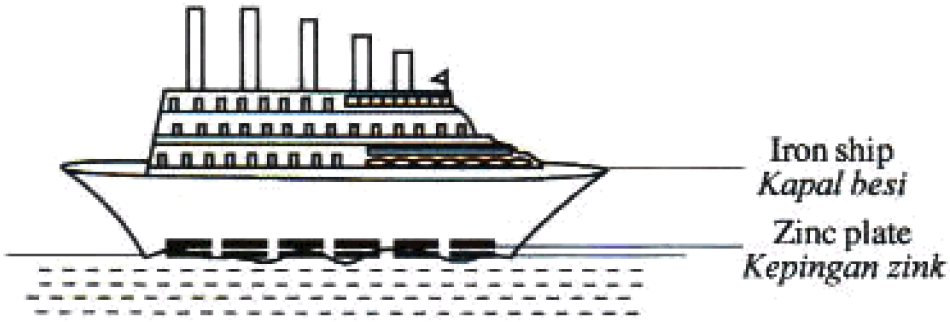


Diagram 6

(i) Explain how the zinc plates protect the iron ship from rusting. [2 M]

.....

.....

(ii) Write the half equation for the reaction in 6(c)(i). [1M]

.....

Essay {Paper02}

[SBPtrial04-10] {Translate}

(a) Displacement reaction of metal as redox reaction.

By using the suitable example, explain the statement above from based on [4M]

(i) Transfers of electrons
(ii) Changing of oxidation of number

(b)(i)

The arrangement of apparatus above is the experiment to determine the effect of other metal in rusting of iron. Explain why the iron nail in the test A not rust but the iron nail in the test B is rusting. [10M]

(ii) Give two other ways to prevent rusting of iron nail. [2M]

----------oooOO aĎaŽ OOooo----------

[SBPtrial05-08] {Translate}

A students has do two experiment by using the acidified potassium manganate(IV) solution into the iron(II) sulphate and potassium iodide separately.

(a) State the observation into three of the solutions in the both of experiment was done. [3M]

(b) Determine the oxidation number for manganese in the potassium manganate(VII). [2M]

(c) Choose one of the experiments above, explain the redox reactions based on changing of oxidation numbers. In your answer, include the half equation for the reactions. [6M]

(d) By using the chemical substance, materials and apparatus from the experiment above, describe one experiment used the transaction of electrons in a distance to produce the electrical energy. In your answer, include the diagram of apparatus set-up for the experiment and explain how the electrical energy was produce. [9M]

----------oooOO aĎaŽ OOooo----------

[SBPtrial06-09] {Translate}

Redox reaction involve the transfers of electrons and the changing of number of oxidation of substance

(a) What mean by the oxidation and reduction based on electrons transfer. [2M]

(b) **Neutralisation reaction is not redox reactions.**

By choose one example of neutralisation, prove the statement above based on the changing of oxidation number. [4M]

(c) Based redox reaction, the iron(II) ion can be change to iron(III) ion.

By using suitable substance, describe the experiment how the changing above can be done. In your explanation, include the observation, ionic equation, redox reaction involve and state how your confirm the product produce. [14M]

----------oooOO aĎaŽ OOooo----------

[MRSM10-08d]

(*d*) The following equations show two redox reactions involving iron(II) ion, Fe2+.

I	$2\ Fe^{2+}$	+	Br_2	→	$2\ Fe^{3+}$	+	$2\ Br^-$
II	Fe^{2+}	+	Zn	→	Fe	+	Zn^{2+}

Compare the role of Fe^{2+} ion in both reactions. Explain your answer. [6 *marks*]

----------oooOO aĎaŽ OOooo----------

[SBPtrial07-09]

(a) Define oxidation and reduction in term of changes in oxidation number. [2M]

(b) Based on electron transfer, explain the oxidation and reduction reaction in

(i) changing of Fe^{2+} ions to Fe^{3+} ions
(ii) changing of Fe^{3+} ions to Fe^{2+} ions

Use a suitable example for each of the reaction. Include half equations in your answers. [8M]

(c) **Electrical energy can be produced by redox reaction.**

Describe an experiment to prove the above statement by the transfer of electrons at a distance. In your description, include [10M]

- labelled diagram which shows the setup of apparatus
- procedure of experiment
- observations at both electrodes

----------**oooOO aĎaŽ OOooo**----------

[MRSM08-09]

(a) Tin is used to electroplate food can in industries.
Explain why food in a dented can should not be consumed. [4M]

(b) Diagram 9 shows two electrolytic cells using different electrodes.

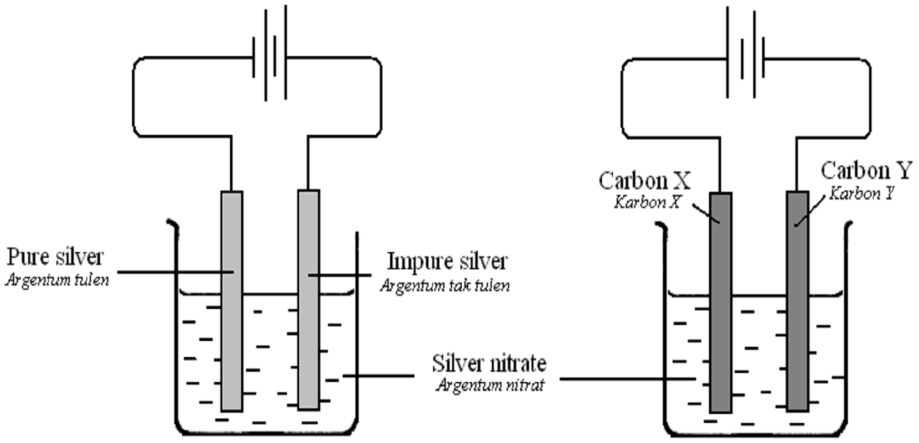


Diagram 9.1

Compare and contrast Cell I and Cell II.
Your answer should include observation and half equation for the reaction at both electrodes.[6M]

The displacement of iodine, I_2 from potassium iodide, KI solution is a redox reaction

(c) Based on the above statement, describe an experiment to verify the reaction that occurred is a redox reaction. [10M]

- In your description, include
- Procedure
- Confirmatory test
- Explanation on oxidation and reduction processes
- Ionic equation

----------**oooOO aĎaŽ OOooo**----------

[MRSM07-09]

(a) The following equations represent two chemical reactions,

I. $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
II. $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

Based on the equations, determine whether the reaction is a redox reaction. Explain your answer. [4M]

(b). Diagram 9 shows a cross section of two iron bars, P and Q which are plated by zinc and tin layers respectively.

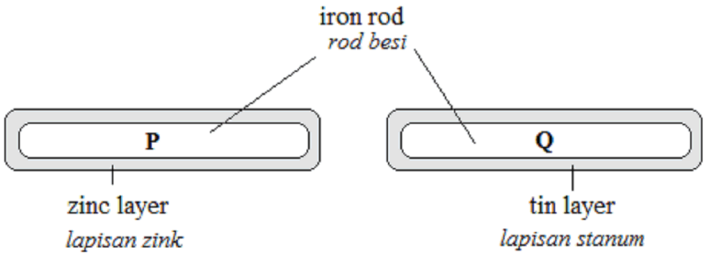


Diagram 9

Explain how zinc and tin layers in P and Q protect the iron bars from corrosion. Determine which iron bar is more protected from corrosion.[6M]

(c) Fe^{2+} ion can be oxidized to Fe^{3+} ion while Fe^{3+} ion can be reduced to Fe^{2+} ion as shown in the following half-equations.

Fe^{2+} -- > Fe^{3+} + e
Fe^{3+} + e -- > Fe^{2+}

Design an experiment to show how these two changes can be carried out. Your answer should consist of the following: [10M]

- Chemicals required
- Procedure of the experiment
- Observation
- Overall chemical equation involved in the reaction

----------oooOO aĎaŽ OOooo----------

[SBPtrial08-10]

(a) Define oxidation and reduction in terms of transfer of electrons. [2M]

(b) The chemical equation below shows the reaction between metal W and copper(II) nitrate solution , $Cu(NO_3)_2$.

$$W(s) + Cu(NO_3)_2\,(aq) \rightarrow Cu\,(s) + W(NO_3)_2(aq)$$

(i) Suggest a metal of W. [1M]

(ii) State three information from the above equation which are related to the position of metal W and copper, Cu in the electrochemical series of metal. [3M]

(iii) Based on the above equation, explain the redox reaction in term of the change of oxidation number. [4M]

(c) **The position of carbon is above metal X and below metal Y in the Reactivity Series of metal.**

You are provided with oxide of metal X (XO), oxide of metal Y (Y_2O_3), carbon powder and apparatus needed. Describe an experiment to verify the above statement.
Your answer should consist of the following: [10M]

- Diagram showing the setup of apparatus
- Procedure of the experiment
- Observation
- Chemical equation.

----------oooOO aĎaŽ OOooo----------

[MRSM04-10]

(a) The iron grills of houses situated near beaches become rusty easier than those situated away from beaches. Explain this phenomenon. [2M]

(b) Diagram 7 shows the changes undergoes by iron (II) ion.

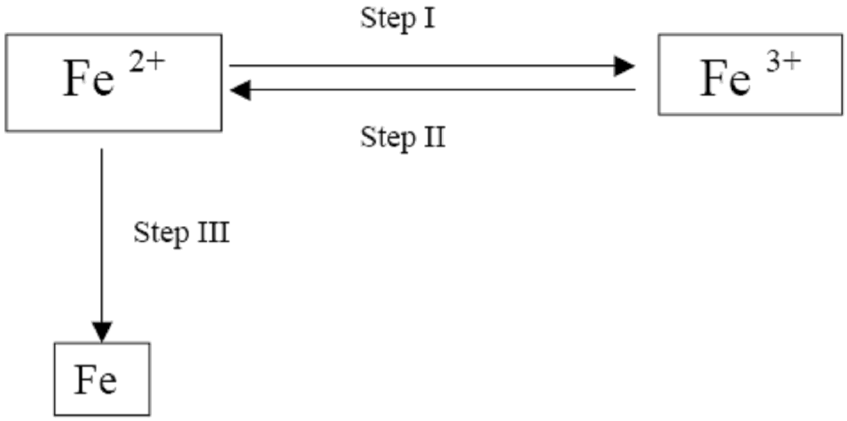


Diagram 7

Complete the flow chart by using named reagent to show the changes in step I, II and III. Include the observation and ionic equations for each step. [9M]

(c) Electric energy can be produced by chemical reactions.
Design an experiment to produce electric energy from the transfer of electrons at a distance using the chemicals listed below.

List of chemicals:

- Potassium iodide solution
- Potassium permanganate solution
- Dilute sulphuric acid

Include the diagram for the apparatus set – up and ionic equations in your answer. [9M]

----------oooOO aĎaŽ OOooo----------

[SBPtrial11-10]

(a) Iron gates of houses situated near industrial areas becomes rusty faster than those situated far from industrial areas. Explain this phenomenon. [2M]

(b) Diagram 10.1 shows the chemical equation for Reaction I and Reaction II. Rajah 10.1 menunjukkan persamaan kimia bagi Tindak balas I dan Tindak balas II.

Reaction I : $HCl\ (aq) + NaOH\ (aq) \rightarrow NaCl + H_2O$

Reaction II : $Mg\ (s) + CuSO_4\ (aq) \rightarrow MgSO_4 + Cu$

Diagram 10.1

Based on the chemical equations in Diagram 10, determine whether the reaction is redox reaction. Explain your answer. [4M]

(c) Diagram 10.2 shows the changes involving iron, iron(II) ion and iron(III) ions.

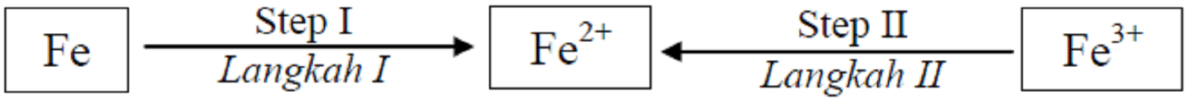


Diagram 10.2

By referring to Diagram 10.2, suggest a suitable chemical substance to carry out the changes in Steps I and II. Your answers should include the observation for each of the step involved. [4M]

(d) The following statement is about redox reaction

A redox reaction can occur between a reducing agent and oxidising agent without in contact with one another.

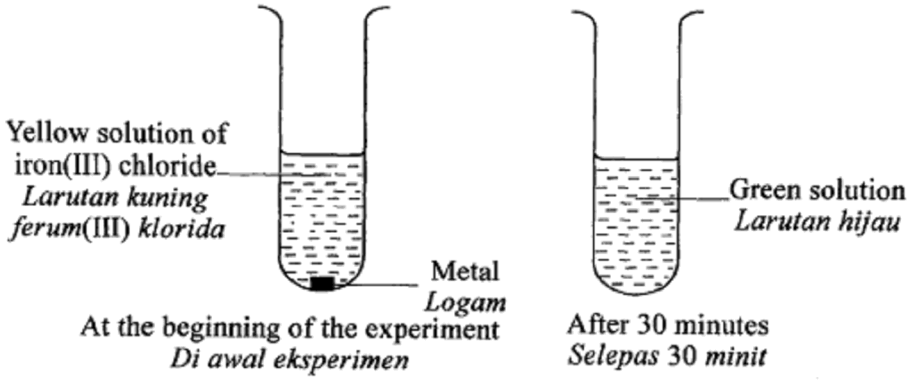
By using potassium iodide solution, dilute sulphuric acid and a suitable oxidising agent, describe an experiment to verify the above statement. Your answer should consist of the following : [10M]

- Labeled diagram
- Procedure
- Half-equations involved
- Observations

----------oooOO aĎaŽ OOooo----------

[SPM09-09]

(a) Diagram 9 shows the apparatus and observations for a redox reaction between iron (II) chloride solution and a metal.



Based on the observation shown in diagram 9, suggest a suitable metal to be used in this experiment.

Predict the ion present in the green solution and explain the answer based on the following aspects:

- The change in oxidation number for both the reactants
- The type of reaction that has occurred to each reactant
- The role of each reactant in the redox reaction
- The half equations involved in the redox reaction

(b) **Iodide ions are good reducing agent**

You are given the following apparatus:
U-tube, galvanometer, connecting wires, stopper, dropper, carbon electrodes and retort stand with clamps.

Suggest a suitable chemical and describe an experiment to verify the above statement using the given apparatus. [10 M]

----------oooOO aĎaŽ OOooo----------

[SPM08-09]

(a) A metal M reacts with oxygen to form an oxide. The oxide is very soluble in water to produce an alkaline solution. Suggest the identity of metal M and describe an observation when the metal you have named reacts with oxygen.
Write the half equation for oxidation and reduction for the reaction. [4M]

(b) Diagram 9 shows an apparatus set-up investigate the effect of two different metals, X and Y on the rusting of iron, Fe.

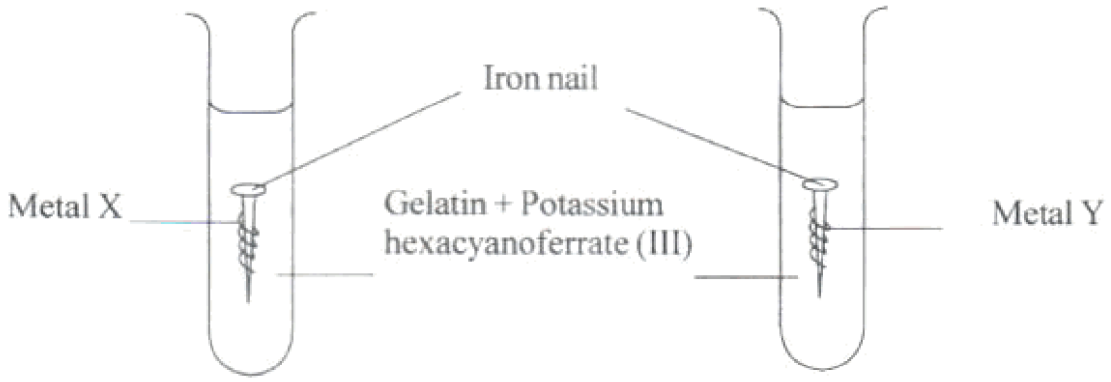


Diagram 9

The result of this experiment after three days is shown in Table 9.

Pair of metals	Observation
Fe, X	Dark blue colour
Fe, Y	No change

Table 9

Based on Table 9, suggest the identity of metals, X and Y.
Give two reasons for each of your choices. [6 M]

(c) Iron (II) ions can be converted to iron (III) ions and iron (III) ions can be converted back to iron (II) ions. By using a named metal as a reducing agent and a named halogen as an oxidising agent, describe briefly how you would carry out these two conversions.

Describe a test to show that each conversion has taken place. [10 M]

----------oooOO aĎaŽ OOooo----------

[SPM05-09]

(a) You have an iron key that rusts easily.
State how you would solve this problem using an electrolysis process. [4M]

(b) Electrolysis is carried out on a dilute sodium chloride solution using carbon electrodes. Explain how this electrolysis occurs. Use a labelled diagram to explain your answer. [6M]

(c) Aluminium is placed above zinc in the electrochemical series.
Aluminium and zinc can be used to build a chemical cell, using suitable apparatus and the following chemicals:

Aluminium sulphate solution
Zinc sulphate solution
Sulphuric acid solution

Describe how you build this chemical cell. Include a labelled diagram in your answer.

On your diagram, mark the direction of the electron flow, the positive terminal and negative terminal. [10M]

[SPM04-10]

(a) Explain what is meant by redox reaction using a chemical equation. [2M]

(b) Table 4 shows the result of two experiments to study the effects of metals P and Q on the rusting of iron. [8M]

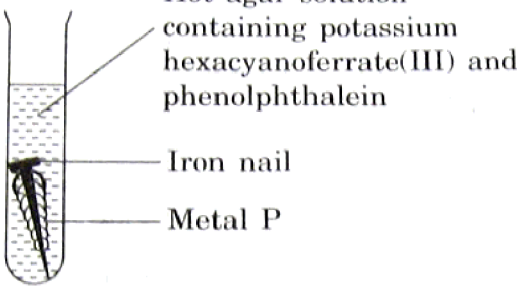
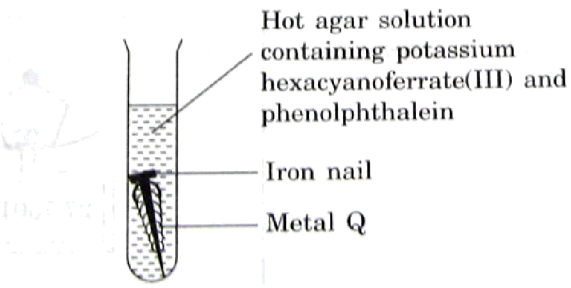
Experiment	Observation
Experiment I  	Blue spots formed in the agar
Experiment II  	Pink spots formed in the agar

Table 4

(i) Explain why there is a difference in observation in Experiments I and II.
(ii) Arrange in descending order metals P, iron and Q based on the electropositivity of the metals

(c) You are provided with strips of metals W, X, Y and Z and their salts solutions. Describe how you would show that the order of these metals in the electrochemical series is W, X, Y and Z in descending order of electropositivity. Your explanation should include observations and conclusions. [10M]

----------oooOO aĎaŽ OOooo----------

[SPM06-07]

(a) The following are the formulae of two compounds.

$$Al_2O_3 \qquad Cu_2O$$

(i) Based on the two formulae, state the oxidation number for aluminium and copper. [2M]

(ii) Name both the compounds based on the IUPAC nomenclature system. [2M]

(iii) Explain the difference between the names of the two compounds based on the IUPAC nomenclature system. [2M]

(b) Diagram 7 shows the setup of the apparatus for an experiment to investigate electron transfer through a solution.

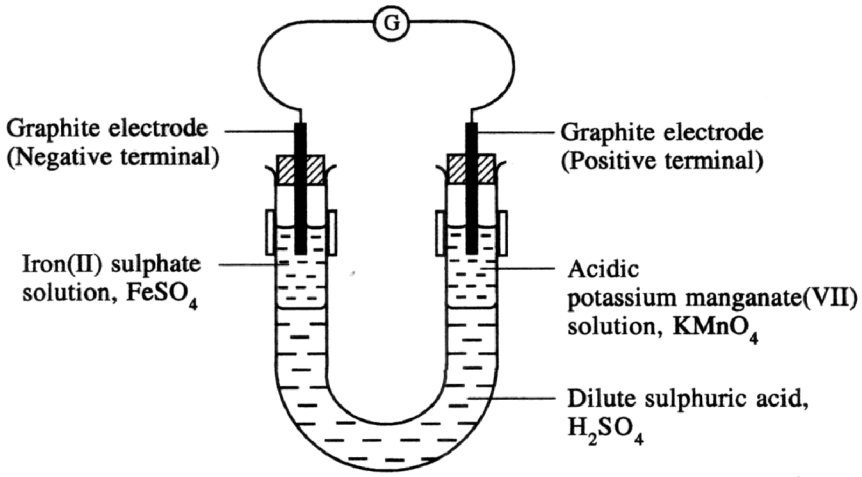


Diagram 7

(i) Name the oxidation agent in the experiment. [1M]

(ii) Write the half equations for the reactions that occur at the negative and positive terminals. [5M]

(iii) Based on your answer in 7(b)(ii), describe the oxidation and reduction process in terms of the electron transfer that occurs at the negative and positive terminals. State also the changes that can be observed after 10 minutes. [8M]

----------oooOO aĎaŽ OOooo----------

Structure {Paper03}

[MRSM11-01]

Diagram 1.1 shows the apparatus set-up for three sets of experiment to investigate the effect of copper and magnesium on the rusting of iron, Fe.

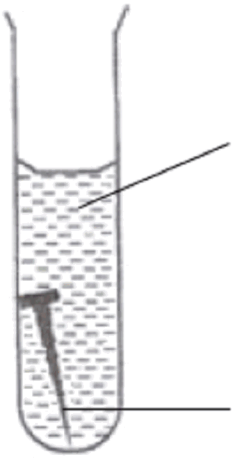
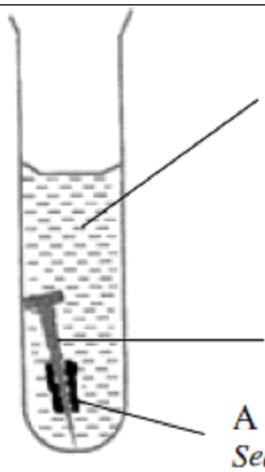
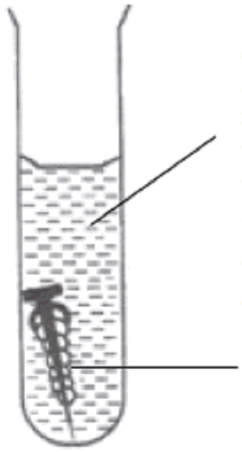
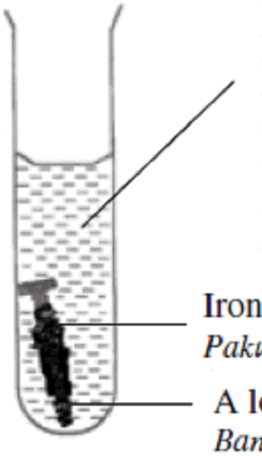
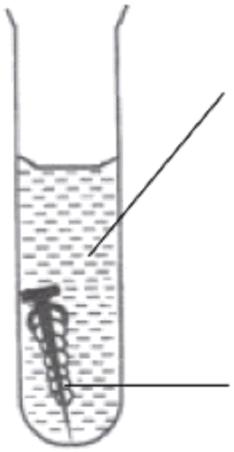
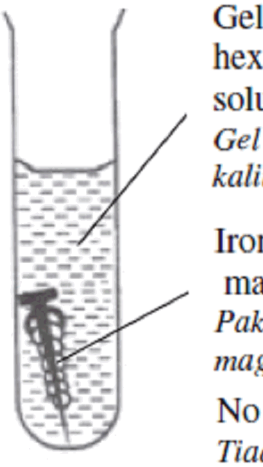
Set	Apparatus set-up	
	Day 1	**Day 5**
I	 Gel containing potassium hexacyanoferrate (III) solution *Gel mengandungi larutan kalium heksasianoferat(III)* Iron nail *Paku besi*	 Gel containing potassium hexacyanoferrate (III) solution *Gel mengandungi larutan kalium heksasianoferat(III)* Iron nail *Paku besi* A few blue spots *Sedikit tompok-tompok biru*
II	 Gel containing potassium hexacyanoferrate (III) solution *Gel mengandungi larutan kalium heksasianoferat(III)* Iron nail coiled with copper *Paku besi dililit dengan kuprum*	 Gel containing potassium hexacyanoferrate (III) solution *Gel mengandungi larutan kalium heksasianoferat(III)* Iron nail coiled with copper *Paku besi dililit dengan* A lot of blue spots *Banyak tompok-tompok biru*
III	 Gel containing potassium hexacyanoferrate (III) solution *Gel mengandungi larutan kalium heksasianoferat (III)* Iron nail coiled with magnesium *Paku besi dililit dengan magnesium*	 Gel containing potassium hexacyanoferrate (III) solution *Gel mengandungi larutan kalium heksasianoferat(III)* Iron nail coiled with magnesium *Paku besi dililit dengan magnesium* No blue spots *Tiada tompok-tompok biru*

Diagram 1.1

(*a*) State one observation that can be obtained from each set of the experiment in Table 1.2. [3M]

Set	Observation
I	
II	
III	

Table 1.2

(*b*)(i) State the inference for each set of the experiment in Table 1.3. [3M]

Set	Inference
I	
II	
III	

Table 1.3

(*b*) (ii) Based on the experiment, arrange the three metals in ascending order of electropositivity. [3M]

.....

(*c*) For the experiment, state: [3M]

(i) The manipulated variable : .....

(ii) The responding variable : .....

(iii) The constant variable : .....

(*d*) State the hypothesis for the experiment. [3M]

.....

.....

.....

(*e*) Another experiment is conducted by coiling the iron nail with silver.
Predict the observation for this experiment compared to the experiments in Diagram 1.1. [3M]

.....

.....

.....

(*f*) State the operational definition for the rusting of iron in the experiment. [3M]

.....

.....

.....

[SBPtrial2010-02]

Table 1 shows the set-up of apparatus and the observations of an experiment to investigate the effect of metal on rusting of iron, when it is in contact with other metals. Potassium hexacyanoferrate(III) is used to test the presence of iron(II) ion in the solution and change the colour to dark blue, while the phenolphthalein is to test the presence of hydroxide ion and the colour change to pink.

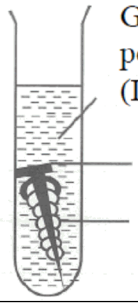
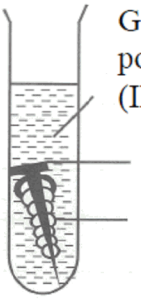
Test Tube	Set-up of apparatus	Observations
A	 Gelatin containing potassium hexacyanoferrate (III) and phenolphtalein Iron nail *Paku besi* Magnesium *Magnesium*	Pink colouration
B	 Gelatin containing potassium hexacyanoferrate (III) and phenolphtalein Iron nail *Paku besi* Copper *Kuprum*	Dark blue coloration

Table 1

(a) State **one** inference for this experiment. [3M]

.....

.....

(b) State the operational definition for the rusting of iron. [3M]

.....

.....

.....

(c) Complete the following half-equations for oxidation and reduction processes that occur in this experiment. [3M]

Oxidation: $Fe \rightarrow Fe^{2+} +$ ☐ e

Reduction: ☐ $H_2O + O_2 +$ ☐ $e \rightarrow$ ☐ OH

(d) The following is the list of metals that can be used to coil the iron nail. [3 marks]

Zinc	Tin
Silver	Aluminium

Classify these metals into metals that can make iron nail to rust and metals that prevent iron nail to rust.

[MRSMtrial04-02-P3]

Diagram 3 shows two different bimetallic strips immersed in beakers M and N containing aqueous sodium chloride. The apparatus set up is left for 24 hours.

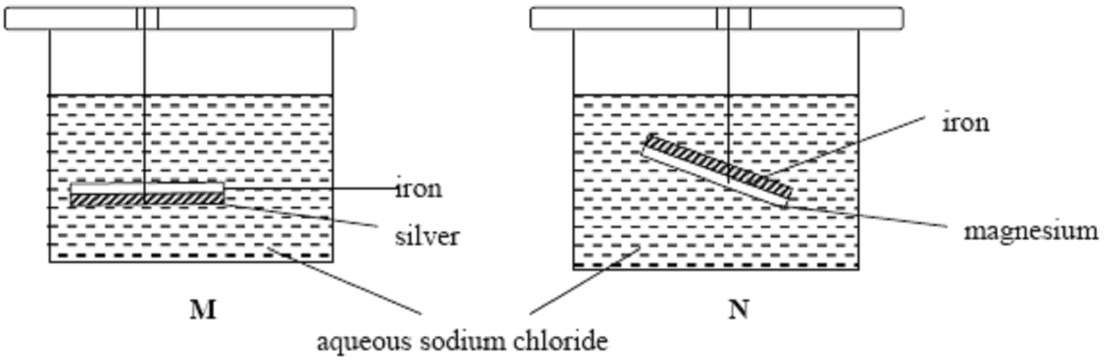


Diagram 3

A few drops of potassium hexacyanoferrate(III) is added to both beakers. The observation is recorded in Table 3.

Beaker	Observation
M	Dark blue precipitate formed
N	No dark blue precipitation

Table 3

(a) State the variables involved in this experiment.

Manipulated variable : .....

Responding variable : .....

Constant variable : .....

(b) State the hypothesis for this experiment.

.....

.....

.....

(c) Categorize the metals used in beakers M and N into anode and cathode.

.....

.....

.....

(d) State the relationship between the amounts of dark blue precipitate formed with time if beakers M and N are left for 5 days.

.....

.....

.....

[SBPtrial05-01-p3] {Translate}

The eksperimen to study redoks reaction between 1.0 mol dm^{-3} potassium iodide with four different solution of P. The diagram 1 below show the arrangement of eksperimen.

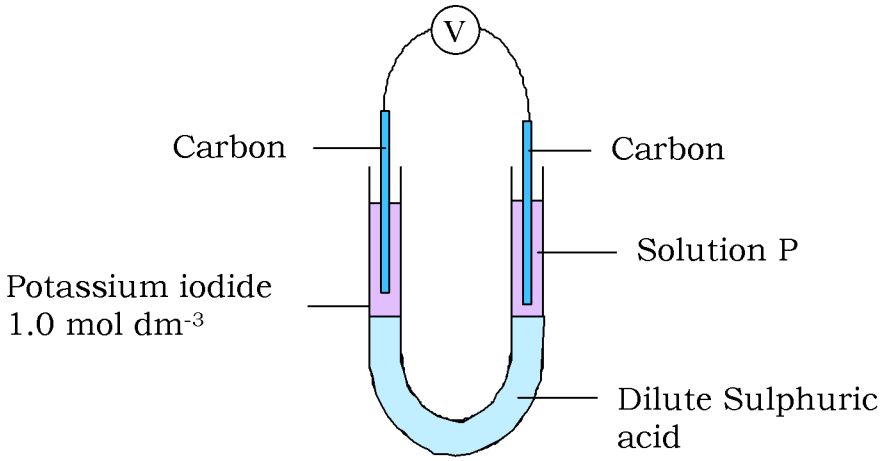


Diagram 1

The solution P used in the experiment are:

Experiment	**Solution of P**
I	Acidified Potassium dicromate (VI) solution
II	Chlorine water
III	Bromine water
IV	Acidifiied Potassium Manganate(VII) solution

The voltmeter reading for four ekperiment shows below:

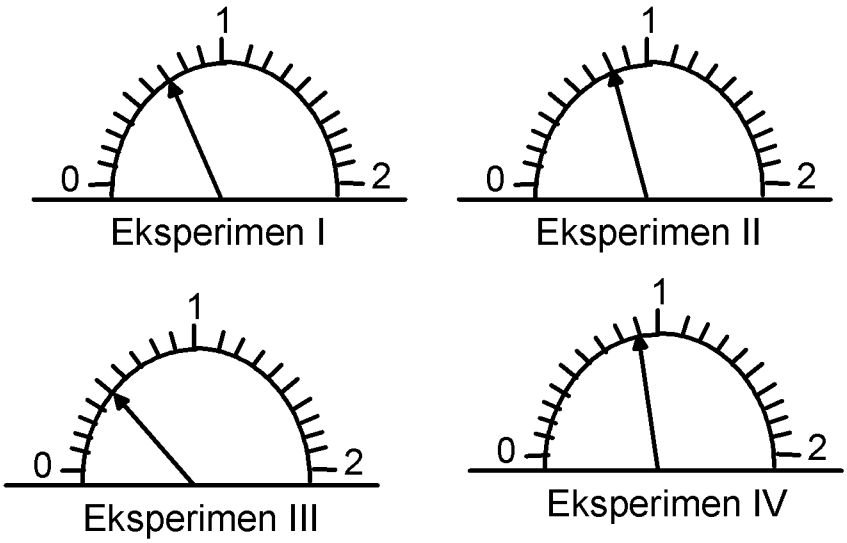


Diagram 2

(a) Statet all the variables involve in the eksperiment: [3M]

Manipulated variable : .....

Responding variable : .....

Contants variable : .....

(b) Record the voltmeter reading for four ekperiment in a table below.[3M]

Eksperiment	**Voltmeter reading, V**
I	----------
II	----------
III	----------
IV	----------

(c) If experiment III was leave for a moment, state the changing colour arround the electrode in bromine water and potassium iodide solution. [3M]

Bromine water : .....

Potassium iodide solution : .....

(d) State the inferens based on the observation at (c). [3M]

.....

.....

.....

(e) Based on the experiment I to IV above, arrange the solutions of P based on decreases power as oxidation agent. [3M]

.....

.....

.....

[SPM04-02-P3]

Metals are arranged in the Reactivity Series based on the reactivity of metal with oxygen.

Figure 2.1 shows the setup of apparatus for an experiment to determine the order of metals in the Reactivity Series.
Potassium manganate (VIII) is heated to release oxygen gas to react with metal powder.

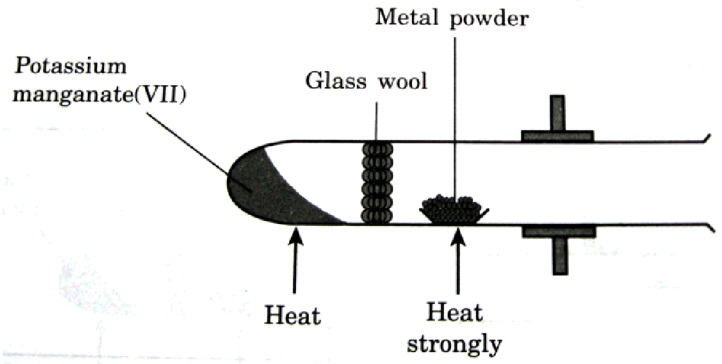
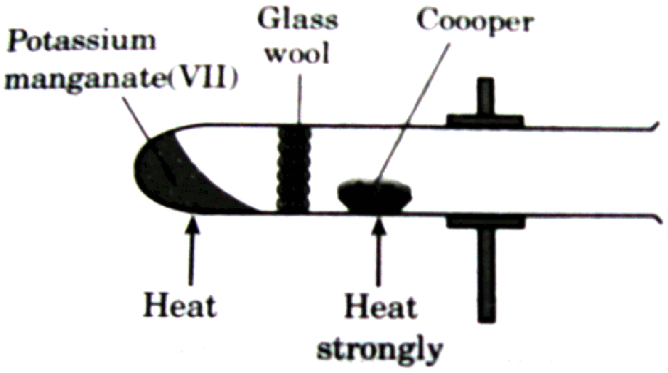
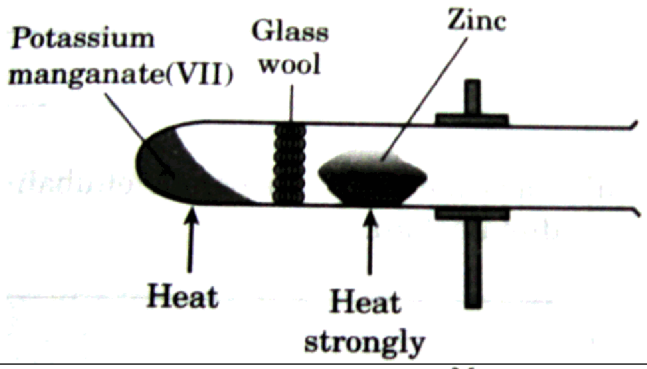
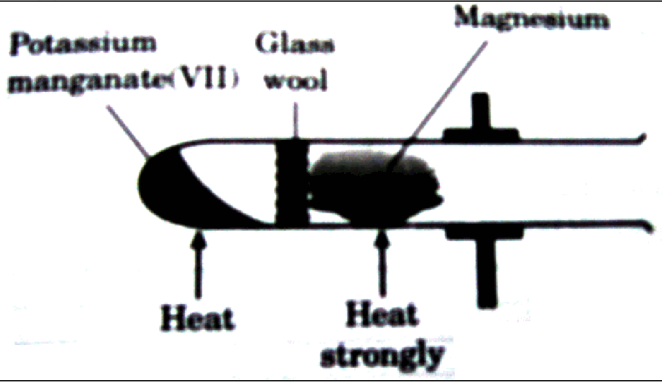


Figure 2.1

The experiment is carried out using metal powders of copper, zinc, magnesium and lead reacted with oxygen respectively.
Observation on the metal powders of copper, zinc, magnesium and lead in the experiments are shown in Figure 2.2.

Set-up of apparatus	Observation of the metal
	Faint glow
	.....
	.....

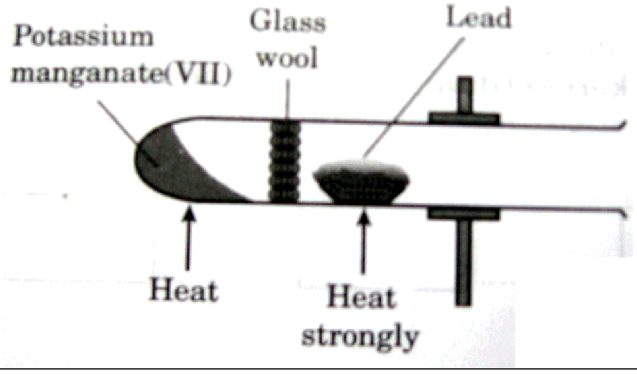
	.....

Figure 2.2

(a) Look at the flame or glow in each diagram in figure 2.2. Complete Figure 2.2 by stating the observations for the reaction of metal powders with oxygen. [3M]

(b) Complete Table 2.3 based of the experiment.

Name of variables	**Action to be taken**
Manipulated variable :	Method to manipulated the variable : ....
Responding variable :	How the variable is responding : ....
Controlled variable :	Method to maintain the controlled variable : ....

Table 2.3

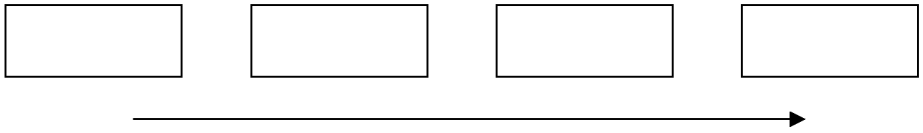
(c) State one hypothesis for the experiment. [3M]

.....

.....

.....

(d)(i) Based on the observation in figure 2.2, arrange copper, zinc, magnesium and lead in descending order of reactivity of metal towards oxygen. [3 M]



Descending order of reactivity of metal towards oxygen

(d) (ii) The experiment is repeated by using aluminium powder to react with oxygen. The result of the experiment is shown in figure 2.4.

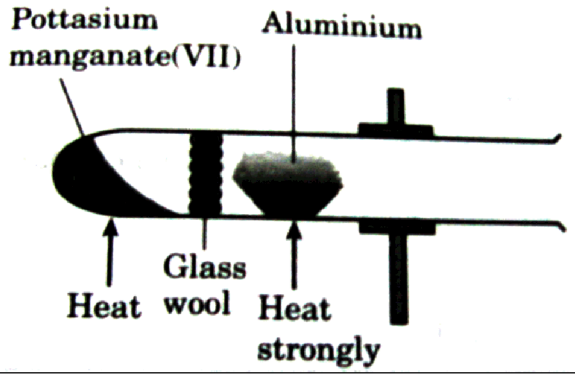
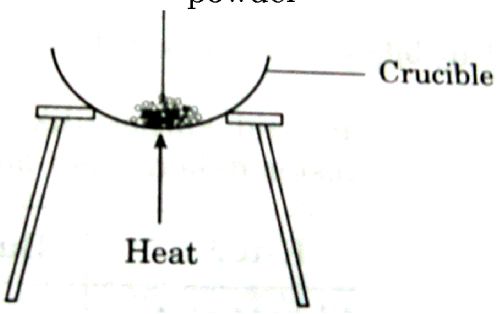
Set-up of apparatus	Observation of the metal
	Moderately bright flame

Figure 2.4

Predict the position of aluminium in the Reactivity Series of metals in (d)(i).
Draw an arrow (↓) in (d)(i) to show the position of aluminium in this reactivity series. [3M]

(e) Figure 2.5 shows the set-up of apparatus to study the reaction of a metal oxide with carbon.

Set-up of apparatus	Observation on the mixture
Mixture of magnesium oxide and carbon powder 	No change

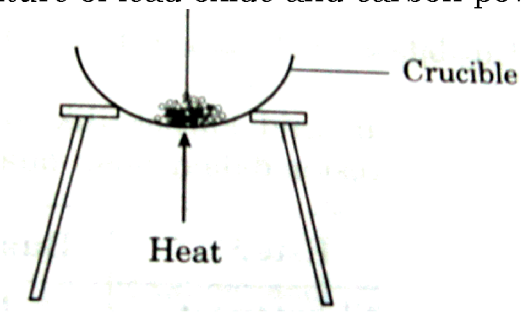
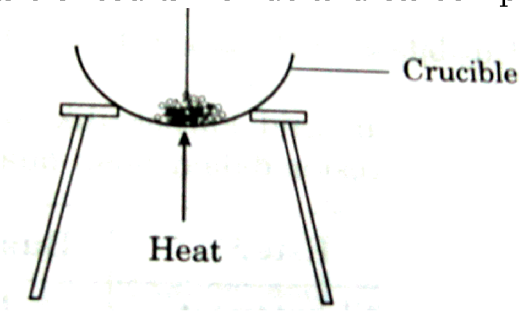
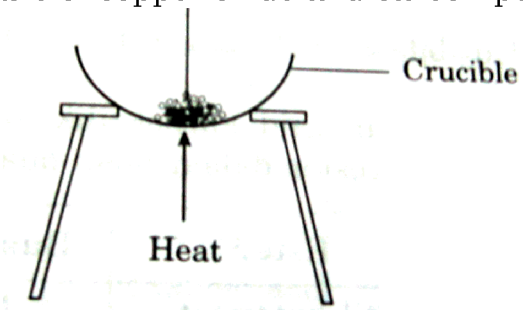
Mixture of lead oxide and carbon powder 	Faint glow
Mixture of sodium oxide and carbon powder 	No change
Mixture of copper oxide and carbon powder 	Bright glow

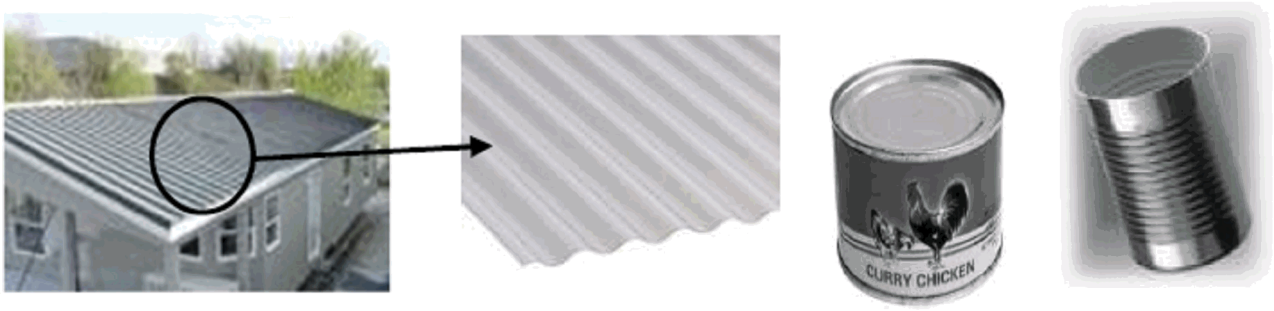
Figure 2.5

Based on the observations in figure 2.5, classify the metals into two groups, those which are more reactive than carbon and those which are less reactive than carbon. Put your answer in a suitable table. [3M]

Essay {Paper03}

[MRSMTrial10-02]

Diagram 2 shows a galvanised zinc roof which is made from iron coated by zinc layer and a food can made from iron coated by tin layer. Both galvanised zinc roof and food can are not easily corroded.



Galvanised zinc roof Food can

Diagram 2

Referring to the above example, plan a laboratory experiment to investigate the effect of other metals on the rusting of iron.

You are given iron nails, magnesium ribbon, zinc strip, copper strip and tin strip.

Your planning should include the following: [17M]

(a) Statement of problem
(b) All the variables
(c) Statement of hypothesis
(d) List of substances and apparatus
(e) Procedure of the experiment
(f) Tabulation of data

[SBPTrial07-03-P3]

A more electropositive metal acts as a sacrificial metal which corrodes itself to protect iron from rusting

You are given the iron nails, magnesium ribbon, zinc strip, copper strip and tin strip.

Referring to a situation above, plan a laboratory experiment to investigate the effect of other metals on the rusting of iron.

Your planning should include the following aspects: [17M]

(a) Statement of the problem
(b) All variables
(c) Statement of the hypothesis
(d) List of materials and apparatus
(e) Procedure of the experiment
(f) Tabulation of data