Essay {Paper02}

[SBPTrial2010-07b]

(b) 1. Lead(II) bromide cannot conduct electricity in the solid state
2. Ions do not move freely
3. Lead(II) bromide can conduct electricity in molten state
4. Ions can move freely
5. Naphthalene cannot conduct electricity in solid and molten state
6. No free moving ions // exist as molecules

Catode
7. Formula of reactants and product correct
8. Balanced
$Pb^{2+} + 2e \rightarrow Pb$

Anode
9. Formula of reactant and products correct
10.Balanced
$2Br^- \rightarrow Br_2 + 2e$

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[SBPdiag08-09]

(a) 1.Electrolyte is an ionic compound that **<u>can conduct electricity</u>** 1
2.in the **<u>molten state or aqueous solution.</u>** 1

(b) 1. In powdered form, lead(II) ions and Bromide **ions cannot** move freely. 1
2. The ions are **held together with strong electrstatic forces** 1
3. In molten state, the **ions can move freely**. 1
4. The **free moving ions carry the electrical charges**. 1

(c) 1. Chemicals required: silver nitrate solution, silver plate, 1
Procedures:
2. [50 – 200]cm^3 of [0.5 – 2.0] mol dm^{-3} of silver nitrate solution is poured into a beaker. 1
3. The silver plate is the anode and the iron spoon is the cathode. 1
4. The silver plate and the iron spoon are connected to the battery with the connecting wires. 1
5. The silver plate and the iron spoon are then dipped into the silver nitrate solution. 1
6. [complete and functional set-up of apparatus] 1
7. [labels: at anode: silver plate, at cathode: iron spoon, electrolyte: silver nitrate solution} 1
8. Half equation at anode: $Ag \rightarrow Ag^+ + e$ 1
9. Half equation at cathode: $Ag^+ + e \rightarrow Ag$ 1
10. Observation: iron spoon is covered with grey, silvery/shiny deposit.

(d) 1. [one example of voltaic cell with complete and functional set-up of apparatus: 1
2. [Labels: at anode: more electropositive metal,eg. Zinc
at cathode: less electropositve metal, eg. Copper]
a suitable electrolyte, eg. Copper(II) sulphate solution] 1
3. Half-equation at anode: $Zn \rightarrow Zn^{2+} + 2e$ 1
4. Half-equation at cathode: $Cu^{2+} + 2e \rightarrow Cu$ 1

[SPM10-09]

a(i) Cu2+ // Copper(ii)//copper ion [sbb conc. Jwpn terbaik adalah Cu]
Zinc/Zn2+ // Magnesium/Mg2+// Iron(ii) / Fe2+ // Lead(II)/Pb2+// Barium/Ba2+// Calcium/Ca2+

Half equation : Cu2+ +2e → Cu
other : 2H + 2e --> H2 [jika larutan selain daripada Cu]

(ii) reduction

(b) 1. ion
2. product
3,4 formation of product
5,6 test and result

Sample
1.nitrate //NO_3
2. oxygen gas
3. OH – selected for discharge
4. OH- is lower than NO3 – in ECS
5. place a glowing splinter into the **test tube**
6. the splinter rekindles/ lights up

1. Cl-/ Br-/ I1
2. Chloride/ Bromine/ Iodine
3. halide is selected for discharge
A: halide release electron at anode
4.concentration of halide is higher
cl
5. put in a damp/moist blue litmus paper
6. turn red and bleaches/ decolourises

Only for $Ba(OH)_2$ and $Ca(OH)_2$
1. OH-
2. oxygen gas
3. OH- is selected for discharge
4. the only anion present in the solution
5. place a glowing splinter into the test tube
6. the gas rekindles/light up the splinter

(c) 1. apparatus : iron spoon, silver plate, wire, dry cell//battery, beaker, silver nitrate

Method
2. clean the iron spoon [with sand paper]
3. pour silver nitrate solution into beaker
4. silver plate as anode// iron spoon as cathode
5. both electrode are immersed in the electrolyte/ solution
6. switch is closed/ complete the circuit// switch on. R : switch open

Diagram
7. functional diagram : batteries, wire, metal plate, spoon both immersed half in electrolyte and solution is dash line
8. labels : spoon must connect to correct terminal

Half equation
9. at cathode : Ag+ +e → Ag
10. at anode : Ag → Ag+ + e

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[SBPdiag06-08c]

(c)(i) Solid sodium chloride cannot conduct electricity, sodium chloride aqueous solution can conduct electricity. 1
In solid state, sodium ions and chloride ions **are held together by strong electrostatic forces // are fixed in their position** and **cannot move freely**. 1
In aqueous state, sodium ions and chloride ions **are free to move.** 1
This enables ions to be discharge at anode and cathode. 1

(c)(ii) Number of moles of NaCl = $0.2 \times 0.05 = 0.01$ 1

Mass of 0.01 mole of NaCl = $0.01 \times 58.5 = 0.585$ g 1

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[MRSM06-07c,d]

(c)(i) 1. CCl_4 adalah sebatian kovalen manakala NaCl sebatian ion
2. CCl_4 mengandungi molekul/ tiada ion
3. NaCl mengandungi ion Na^+ dan Cl^-
4. yang bergerak bebas/ membawa cas

(ii) 1. Dalam elektrolisis NaCl, ion Na+ dan H+ ditarik/ bergerak ke katod
2. ion H+ dinyahcas / terima electron
3. kerana terletak di bawah Na+ dalam Siri Elektrokimia
4. Dalam elektrolisis $CuCl_2$, ion Cu^{2+} dan H+ ditarik ke Katod
5. ion Cu^{2+} dinyahcas/ terima elektron
6. kerana terletak di bawah H+ dalam siri elektrokimia

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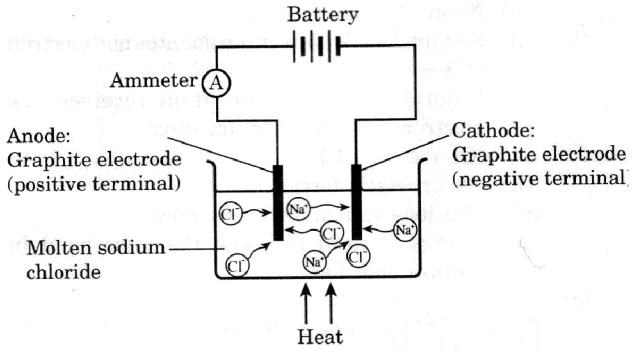
[SPM06-10]

(a) sodium chloride

(b) At anode: $2Cl^- \rightarrow Cl_2 + 2e$ //

At cathode: $Na^+ + e \rightarrow Na$

(c)



(d) During electrolysis of molten sodium chloride,
chloride ions are attracted to the anode whereas sodium ions are attracted to the cathode.

At the anode, Cl^- ions are discharged to form chlorine gas.
$2Cl^- \rightarrow Cl_2 + 2e$

At the cathode, Na^+ are discharged to form sodium.
$Na^+ + e \rightarrow Na$

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[SBPdiag05-essay02]

(a) Natrium klorida adalah sebatian ion 1
sodium chloride an ionic compound 1
Dalam keadaan pepejal, ion-ion //Na^+ dan Cl^- terikat kuat (oleh daya tarikan elektrostatik) 1
in solid, ions / ion Na+ and Cl- was attract by a strong force 1
tidak bergerak bebas
no free moving ions
Apabila lebur ion-ion bergerak bebas
when it molten, ions is free moving ion

(b)(i) Hasil di anod pada sel A : (gas) oksigen 1
anode product at cell a : Oxygen gas 1
Hasil di anod pada sel B : ion kuprum(II) // ion Cu^{2+}
cathode product at cell b : ion copper (II) // ion Cu^{2+}

1

Cell A: $4OH^- \rightarrow 2H_2O + O_2 + 4e$

1

Cell B: $Cu \rightarrow Cu^{2+} + 2e$

(b)(ii) Keamatan warna biru pada sel A berkurang//warna biru menjadi pudar 1
Blue color at cell a changed to colourless/ pale blue 1
tetapi pada sel B (keamatan warna biru) tidak berubah
But at cell B, blue color unchanged/ maintain

1

Sel A - kepekatan larutan kuprum(II) sulfat // ion kuprum(II) berkurang //ion-ion kuprum(II) dinyahcas
At Cell a – concentration copper (II) sulphate solution // ion copper (II) 1
decreased// ions copper (ii) was discharge

Sel B – kadar ion kuprum(II) yang dinyahcas dan yang terbentuk adalah sama
At Cell b – rate of copper (II) ion discharge and formed a same

(c) [Gambar rajah –susunan radas] : sel elektrolisis berfungsi
Diagram – apparatus arrangement : electroclysis cell with fucntion 1
(elektrod argentum, sel kering, ammeter, dan larutan dilorek)
Silver electrode, dry cell, ammeter, and shade for the solution 1

[label]: anod, argentum ; katod, sudu besi dan elektrolit, larutan 1
argentum nitrat 1
Label : anode, silver ; catode, iron spoon and electrolyte, silver nitrate 1
solution 1
1

Logam argentum dijadikan anod 1
sudu besi dijadikan katod
dicelupkan ke dalam larutan argentum nitrat
kedua-dua elekktrod disambungkan kepada punca arus/bateri
[persamaan] di anod $Ag \rightarrow Ag^+ + e$
[persamaan] di katod $Ag^+ + e \rightarrow Ag$

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[SBPtrial05-04c] {Translate}

(c) Eksperimen penyaduran besi dengan argentum
[Markah 1 dan 2 adalah untuk gambar rajah]
1. [Susunan radas]:
   [Elektrod logam argentum. Cincin besi, (sel kering), ammeter, larutan berlorek]1
2. [Label]
   [Anod, argentum; katod, cincin besi; elektrolit, argentum nitrat]

[Markah 3 hingga 6 ialah prosedur]
3. Isikan larutan argentum nitrat ke dalam sebuah bikar
4. Sambungkan elektrod argentum ke terminal positif sel kering dan cincin besi ke terminal negatif menggunakan wayar
5. Celupkan elektrod argentum dan cincin besi ke dalam larutan argentum nitrat 1
6. Lengkapkan litar

[Markah 7 hingga 10 ialah untuk pemerhatian dan persamaan]
7,8 [Pemerhatian]
Elektrod argentum melarut/menipis reject: terkakis
Enapan kelabu berkilat terbentuk di permukaan cincin besi
9,10[Persamaan]
Di anod : $Ag \rightarrow Ag^+ + e$
Di katod: $Ag^+ + e \rightarrow Ag$

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[SPM08-08]

(a) At electrode P/ cathode:
the position of ions in electrochemical series

At electrode Q/ anode: concentration of ions

(b)

Electrode	P/cathode	Q/anode
Ions attracted	Na^+ , H^+	Cl^-, OH^{--}
Ions selectively discharged	Hydrogen ion	Chloride ion
Reason	H+ ions is lower in the electrochemical series	Concentration of Cl^- ions is higher than OH^- ions
Half equation	$2H^+ + 2e \rightarrow H_2$	$2Cl^- \rightarrow Cl_2 + 2e$

(c) (i)

Experiment	I	II	III
Explanation	L is more electropositive than silver. L can displace silver from its solution	M is more electropositive than silver. M can displace silver from its solution	L is more electropositive than M. M cannot displace L from its solution.

Order of the three metals: silver, M, L

(ii) copper(II) nitrate

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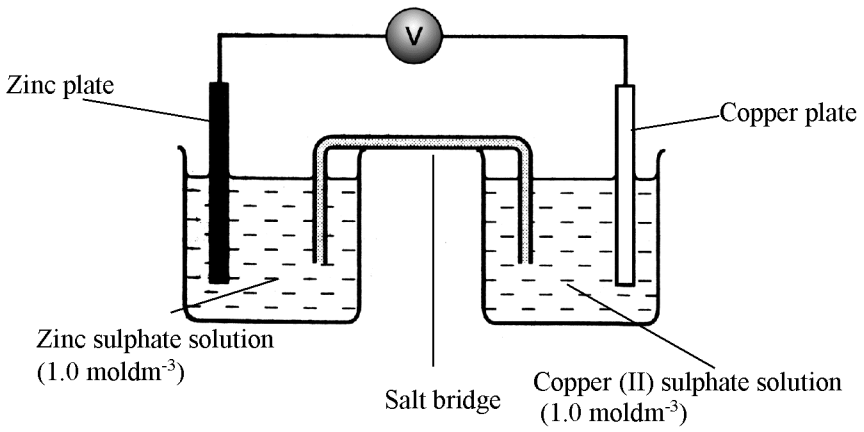
[SBPdiag06-09]

(a) **Cryolite** is added to aluminium oxide to lower its melting point. 1
Molten aluminium oxide is electrolysed using **carbon electrodes**. 1
Aluminium ions are discharged at **cathode**. // $Al^{3+} + 3e \rightarrow Al$ 1
Oxide ions are discharged at **anode**.// $2O^{2-} \rightarrow O_2 + 4e$ 1

(b)



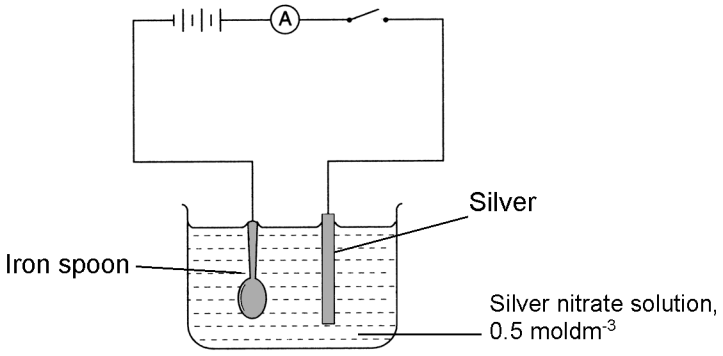
1+1

Zinc is **more electropositive / negative terminal** than copper.
Zinc atom releases electrons to form zinc ions, Zn^{2+} in zinc sulphate solution. // $Zn_{(s)} \rightarrow Zn^{2+}{}_{(aq)} + 2e$ 1 1

The electrons flow from **zinc electrode to copper electrode through external circuit**. 1

At the copper electrode, the electrons are **accepted by the copper(II) ions,** Cu^{2+} to form copper atoms. // $Cu^{2+}{}_{(aq)} + 2e \rightarrow Cu_{(s)}$ 1

(c) **Silver** can be used to electroplate the iron key. 1
The electrolyte is **silver nitrate** solution, [0.5 moldm^{-3}]. 1
[***or other suitable metal and electrolyte***]
The **silver electrode** is connected to positive terminal of battery // act as **anode**. 1
The **iron spoon** is connected to negative terminal of battery // act as **cathode**. 1



1+1

The switch is turned on. 1
Anode
Half equation : $Ag_{(s)} \rightarrow Ag^{+}{}_{(aq)} + e$

Observation : Silver electrode becomes thinner. 1

Cathode 1
Half equation : $Ag^{+}{}_{(aq)} + e \rightarrow Ag_{(s)}$

Observation : A thin layer of shiny grey solid is deposited on the iron spoon. 1

1
[11]

Max. 10

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[SBPTrial2010-09]

(a) (i) 1. Clean the metals with sand paper.
2. Pour copper(II) sulphate solution / any suitable electrolyte into a beaker.
3. Dip a pair of Q and R strips into the beaker.
4. Connect the metals by using connecting wires to a voltmeter.
5. Record the voltmeter reading
6. Determine the negative terminal of the cell.
7. Repeat steps 1 – 6 by replacing the pair of Q and R strips with other pairs of metals as shown in the table.
8. The negative terminal metal located higher than the other metal.in the electrochemical series //
Q is placed higher than R, R is placed higher than S and P is placed higher than S in the electrochemical series
9. Pair of metals which produced the biggest potential difference located the furthest in electrochemical series // P and S has the biggest potential difference indicate the pair of metal located furthest apart in the Electrochemical series.

10 P, Q, R, S → Electropositivity decrease

(ii) 1. Value of x = 1.6 V
2. y = P
3. P is magnesium / metals that is higher than zinc in electrochemical series
4. P / Mg is more electropositive than Q / Zn // P / Mg is higher than Q / Zn in electrochemical series

(b) **1.0 mol dm-3 sodium chloride**
1. Chloride / Cl- ions discharged at the anode
2. Concentration of Cl- ions is higher than H+ ions
3. Chlorine gas is released

0.0001 mol dm-3 sodium chloride
4. H+ ions discharged at the anode
5. H+ ions is lower than Cl- ions in electrochemical series
6. Hydrogen gas which is colourless released

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[SPM09-08]

(a) (i) W, X, Y, Cu
(ii) 1. Positive terminal is Cu
2. because Cu is less electropositive than X
3. the potential difference is 1.3 V

(b) 1. Positive terminal is Q
2. and negative terminal is Cu
3. Suitable metal Q is Silver
4. Solution R is silver nitrate solution

(c) (i) **Experiment I**
1. Product at anode : Oxygen
2. Anions present are OH- and I- //OH- ion was selected because factor of position (less electronegative)
3. $4OH^- \rightarrow 2H_2O + O_2 + 4e$

4. Product at cathode : hydrogen
5. Cations present are H+ and K+ //H+ ion was selected to discharge because factor of position
6. $2H^+ + 2e \rightarrow H_2$

Experiment II
1. Product at anode : Iodine
2. Anions present are OH- and I- //I- ion was selected because factor of concentration
3. $2I^- \rightarrow I_2 + 2e$

4. Product at cathode : hydrogen
5. Cations present are H+ and K+ //H+ ion was selected to discharge because factor of position
6. $2H^+ + 2e \rightarrow H_2$

(ii) $2H^+ + 2e \rightarrow H_2$

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[SBPdiag07-08]

(a) (i) Any suitable electrolyte. Example sodium chloride solution

(ii)[**Between P and Q]**
1. Q is the negative terminal. So, P is below Q.

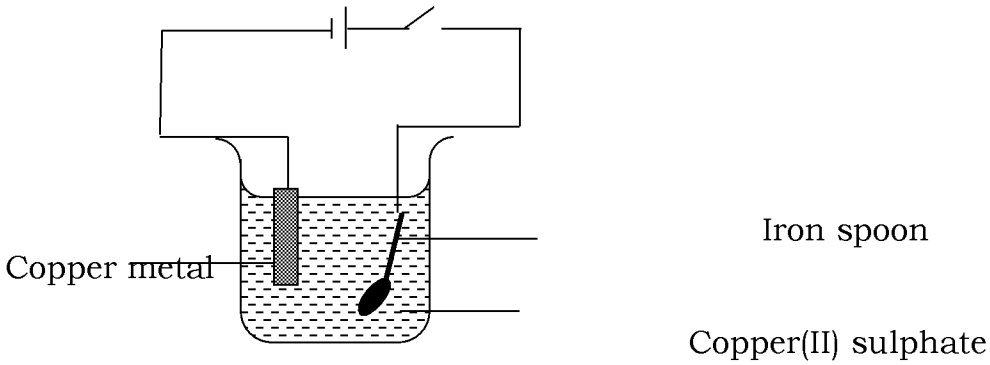
[**Between Q and R**]
2. R is the negative terminal. So, Q is below R.

[**Between P and S]**
3. S is the negative terminal So, P is below S.
4. But, the potential difference between P and S metal is the biggest. So, P and S are situated farthest apart.
5. S is the most electropositive metal while P is the least electropositive metal.

6. Arrangement in descending order :
S, R, Q, P

(iii) 1. metal Q
2. Because metal Q is less electropositive than metal S
3. 0.6 V [value and unit correct]

(b)



[Diagram]
1. Diagram complete and functional
2. Labels correct

[Chemicals + Procedures]
3. Iron spoon is used as the cathode/connected to the negative terminal of the dry cell
4. Copper metal is used as the anode/connected to the positive terminal of the dry cell
5. Copper (II) sulphate solution/any suitable copper salt solution is used as the electrolyte
6. Turn on the switch./ circuit is completed

[Observations]
7. At anode : The size / mass of the copper metal decreases.
8. At cathode : The iron key is coated with a brown layer of metal

[Chemical equations]
9. At anode : $Cu \rightarrow Cu^{2+} + 2e^-$
10. At cathode : $Cu^{2+} + 2e^- \rightarrow Cu$

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[SPM03-09]

(a) Hydrogen gas.
$2H^+ + 2e \rightarrow H_2$

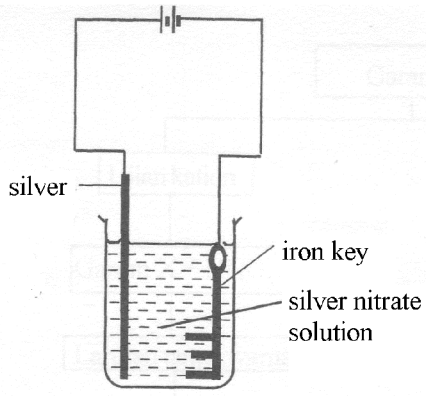
(b)

	Cell P	**Cell Q**
Type of cell	Electolytic cell	Chemical/voltaic cell
Energy change	electrical → chemical	chemical → electrical
Name of electrode	Both electrodes are copper	Copper = positive electrode zinc = negative elctrode
Ions in electrolyte	Cu^{2+}, SO_4^{2-}, H^+ , OH^-	Cu^{2+}, SO_4^{2-}, H^+ , OH^-
Half equations	At anode: $Cu \rightarrow Cu^{2+} + 2e$ At cathode: $Cu^{2+} + 2e \rightarrow Cu$	 $Zn \rightarrow Zn^{2+} + 2e$ $Cu^{2+} + 2e \rightarrow Cu$

Observation	At anode: Copper dissolves. At cathode: Brown solid forms.	Zinc dissolves. Brown solid forms.

(c) To electroplate a key with silver:
Chemicals required:
silver, silver nitrate solution
Procedures of the experiment:
Key is made the cathode.
Silver is made the anode.
Electrolyte used is silver nitrate solution in a beaker.
The silver anode and the key are immersed into the electroyte and connected to a battery.

Diagram showing the set-up of the apparatus



Chemical equation involved in the reaction:

At anode:
$Ag \rightarrow Ag^+ + e$

At cathode:
$Ag^+ + e \rightarrow Ag$

Observation:

At anode:
Silver dissolves.

At cathode:
Shiny solid forms.

No change in the colour of the solution.

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