

JUNIOR LYCEUMS ANNUAL EXAMINATIONS 2000

Educational Assessment Unit - Education Division

FORM 4

CHEMISTRY

TIME : 1hr 30min

Name: _____

Class: _____

Useful Data: A copy of the Periodic Table is provided with this paper.
One mole of any gas occupies 22.4 dm³ (22400cm³) at s.t.p.
Relative atomic masses. C = 12, O = 16, Fe = 56, Na = 23.

Section A: Answer **All** questions in this section, using the spaces provided.
This section carries 60 marks.

1. Iron is extracted in a Blast Furnace

(a) (i) Name **two** *raw materials* that go into a Blast Furnace.

(ii) Name **two** substances, (*apart from iron*), that come out of a Blast furnace.

_____ (4 marks)

(b) Most of the iron leaving the furnace is converted into steel.

(i) Give **one** reason why pig iron is not as useful as steel.

(ii) Give **one** use of steel and state the property upon which this use depends

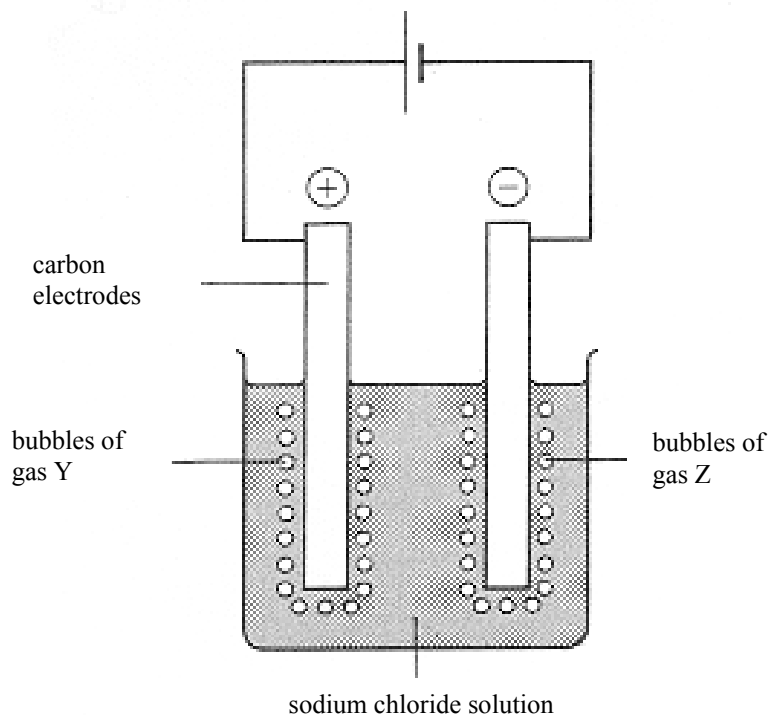
_____ (3 marks)

2. Complete this table:

chemical	large-scale use
copper	
	manufacture of bleaches
nitric acid	
	construction of aircraft

(4 marks)

3. The diagram below shows the electrolysis of concentrated sodium chloride solution in the laboratory.



If a few drops of universal indicator are added to the solution before electrolysis starts, the indicator is green.

As electrolysis happens, the indicator turns blue around the cathode while around the anode first it turns red, then colourless.

- (a) (i) Name the gases Y and Z.
_____ (2 marks)
- (ii) Explain, in terms of the ions present in solution, what causes the indicator to go blue at the cathode.

_____ (2 marks)
- (iii) Suggest a reason for the colour changes at the anode.
_____ (1 mark)
- (b) Name a **compound** produced on an **industrial scale** by the electrolysis of sodium chloride solution.
_____ (1 mark)

4. Cobalt, symbol Co, is a metal that is similar to iron and copper.

(a) Cobalt can be extracted by roasting cobalt ores to give cobalt oxide, CoO , which may be reduced to cobalt using hydrogen.

(i) What is an ore? _____
_____ (1 mark)

(ii) Write an equation for the reduction of cobalt oxide by hydrogen.
_____ (2 marks)

(iii) Name another substance which you would expect to reduce cobalt oxide.
_____ (1 mark)

(b) Cobalt is a transition metal. State **two** properties you would expect cobalt to have, which are typical of a transition metal.

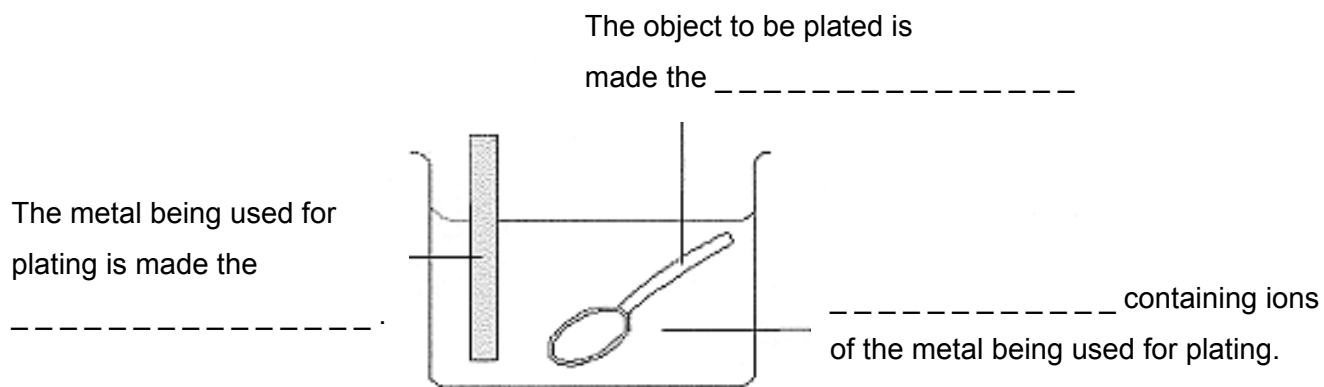
_____ (2 marks)

(c) The chemical properties of cobalt are similar to those of iron. Using your knowledge of the reactions of iron, write equations for the reactions of cobalt with

(i) dilute hydrochloric acid

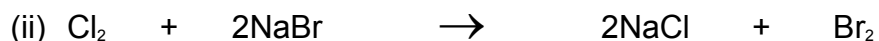
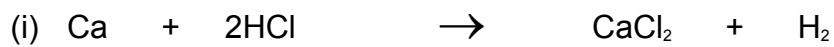
(ii) with chlorine
_____. (4 marks)

(d) Cobalt has been used for electroplating in a similar way to copper. Complete the labelling of the diagram below, which could be used to electroplate a spoon with cobalt.



(3 marks)

5. (a) Rewrite the following equations as an ionic equation, (omitting spectator ions).



(4 marks)

(b) Explain, in terms of electrons, why

(i) calcium is oxidised in equation (a)(i) above.

(ii) chlorine is reduced in equation (a)(ii) above

(2 marks)

6. State what you would SEE when each of the following tests are carried out, which would enable you to distinguish between each pair of substances.

(a) A flame test is carried out on salts containing Na^+ and K^+ ions.

Na^+ gives a _____ colour, while K^+ gives a _____ colour.

(b) Acidified silver nitrate solution is added to solutions containing Cl^- and I^- ions.

(i) With Cl^- a _____ precipitate is formed,

(ii) With I^- a _____ precipitate is formed.

(c) Sodium hydroxide solution is added to solutions containing Cu^{2+} and Fe^{2+} ions.

(i) With Cu^{2+} a _____ precipitate is formed

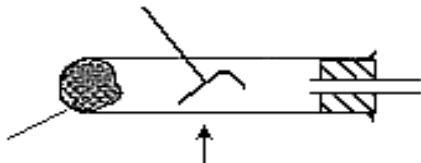
(ii) With Fe^{2+} a _____ precipitate is formed.

(d) Give an ionic equation to show the formation of one of the precipitates formed in (c).

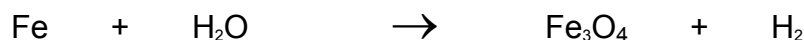
(8 marks)

7. Triiron tetraoxide and hydrogen are formed when iron reacts with steam.
- (a) Label the diagram below, which shows a set up suitable for carrying out the reaction in the laboratory.

Complete the diagram to show how a test-tube of the hydrogen given off can be collected. (5 marks)



- (b) The unbalanced equation for the reaction of iron with steam is



- (i) Balance the equation
- (ii) If 4.2g of iron reacts completely with steam, calculate the maximum volume of hydrogen which could be collected at standard temperature and pressure. (3 marks)
- (c) (i) Name one other metal which could safely be used in place of iron in the reaction.

- (ii) Name one metal which would not react with steam under any conditions.
_____ (2 marks)

8. This question is about experiments that were carried out using compounds of nitrogen.

- (a) Experiment 1. Some fertiliser is mixed with calcium hydroxide powder and warmed. A gas, (A), is given off which turns damp litmus paper blue.
- (i) Name gas (A), _____
- (ii) Name the ion, or suggest the name of a compound of nitrogen, which must be present in the fertiliser. _____ (2 marks)
- (b) Experiment 2. When heated strongly, a white crystalline solid, (B), decomposed to produce a brown gas, (C), and oxygen, leaving a yellow residue.
- (i) Name gas (C), _____
- (ii) Suggest the name of solid (B). _____ (2 marks)
- (c) Experiment 3. A colourless gas (D) was first produced, but this gas immediately reacted with oxygen in the air to form the brown gas (C).
- (i) Name gas (D), _____
- (iii) Give an equation to show gas (D) reacting with oxygen to form gas (C).
_____ (2 marks)

Section B: Answer **Two** questions from this section on the separate sheets provided.
Each question carries 20 marks.

9. (a) Briefly describe a simple laboratory experiment or reaction to confirm the following trends going down groups of the Periodic Table.
- (i) The Group 1 element potassium is *more* reactive than sodium.
 - (ii) The Group 7 element bromine is *less* reactive than chlorine.
- Your answers should include the names of the reagent(s), the observations and an equation for the reaction. (10 marks)
- (b) A class is investigating the reactivity of the following metals: nickel, lead and zinc. It is suspected that nickel lies between zinc and lead in the electrochemical (activity) series.
- The class had available samples of the three metals and solutions of their nitrate salts - $\text{Zn}(\text{NO}_3)_2$, $\text{Pb}(\text{NO}_3)_2$, $\text{Ni}(\text{NO}_3)_2$.
- (i) Draw up a table of the results of the displacement reactions which would verify this order of reactivity. Use a \checkmark to show when displacement occurs and a \times to show no reaction. (6 marks)
 - (ii) Give an equation for one of the displacement reactions that occurs. (2 marks)
 - (iii) How would you expect nickel to react with dilute sulphuric acid? (2 marks)
10. (a) Some of the substances that sulphuric acid reacts with are:
(i) magnesium (ii) copper (II) oxide (iii) potassium chloride
- For each reaction, state whether *concentrated* or *dilute* acid should be used, what would be observed and write an equation for the reaction. (12 marks)
- (b) Concentrated sulphuric acid acts as an oxidising agent in its reaction with copper metal. One of the products is sulphur dioxide gas
- (i) Give an equation for the reaction and use it to explain why concentrated sulphuric acid acts as an oxidising agent. (3 marks)
 - (ii) Sulphur dioxide is itself a reducing agent. Briefly describe a test given by sulphur dioxide which shows that it acts as a reducing agent. (An equation is not required). (2 marks)
- (c) Concentrated sulphuric acid acts as a dehydrating agent in its reaction with sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$. Explain this statement and state what would be seen during the reaction. (3 marks)
11. (a) Describe, in detail, how you would prepare 250cm^3 of a standard solution of anhydrous sodium carbonate. Include all practical steps and precautions required to ensure accuracy. (10 marks)
- (b) 25cm^3 of a sodium carbonate solution of molar concentration 0.02M (0.2 mol dm^{-3}) required 20cm^3 of dilute hydrochloric acid solution to neutralise it.
- (i) Calculate the mass of anhydrous sodium carbonate used to prepare 250cm^3 of the standard solution. (3 marks)
 - (ii) Give the equation for the reaction of sodium carbonate with nitric acid. (2 marks)
 - (iii) Calculate the molar concentration (molarity) of the nitric acid. (5 marks)
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