AS LEVEL CHEMISTRY

REDOX

GROUP 2

GROUP 7

Answer all questions

Max 53 marks

Name	……..
Mark	……../53 …….....% Grade ……

1. A student prepared an aqueous solution of calcium chloride by reacting calcium with hydrochloric acid.

The student added the exact amount of calcium so that all the hydrochloric acid had reacted. She used 50 cm^3 of 2.0 mol dm^{-3} HC*l*.

(i) How many moles of HC*l* had she used?

[1]

(ii) Calculate the mass of calcium that she used.

[2]

(iii) The student added some more calcium and she was surprised that a reaction still took place.

- Explain this observation.
- Write a balanced equation for this reaction.

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[3]

[Total 6 marks]

2. This question is about elements and compounds of Group 2 of the Periodic Table.

When calcium is added to water, a vigorous reaction takes place, releasing hydrogen gas.

$$Ca(s) + 2H_2O(l) \rightarrow Ca\{OH)_2(aq) + H_2(g)$$

(i) Suggest a value for the pH of the solution formed in this reaction.

.....

[1]

(ii) Complete the electronic configuration of calcium in

Ca(s) $1s^2 2s^2 2p^6$ .....

$Ca(OH)_2(aq)$ $1s^2 2s^2 2p^6$ .....

[2]

[Total 3 marks]

3. The Group 2 metal strontium, Sr, is very reactive.

Strontium metal is stored under oil and, when exposed to air, the shiny surface of the strontium becomes dull.

Predict, with an equation, what reaction takes place when strontium is exposed to air.

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[Total 2 marks]

4. The reaction of strontium with water is a redox reaction. A student reacted 0.438 g of strontium with 200 cm^3 of water.

$$Sr(s) + 2H_2O(l) \rightarrow Sr(OH)_2(aq) + H_2(g)$$

(i) Use oxidation numbers to show that strontium has been oxidised in this reaction.

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[2]

(ii) Calculate how many moles of Sr were reacted.

A_r: Sr, 87.6

answer ..... mol

[1]

(iii) Calculate the volume, in dm^3, of $H_2(g)$ produced. You can assume that, under the experimental conditions, 1.00 mol of $H_2(g)$ has a volume of 24.0 dm^3.

answer ..... dm^3

[1]

(iv) Calculate the concentration, in mol dm^{-3}, of the $Sr(OH)_2$ produced.

answer ..... mol dm^{-3}

[1]

[Total 5 marks]

5. An ore of strontium contains strontium carbonate, $SrCO_3$.

To obtain metallic strontium,

- the $SrCO_3$ is converted into strontium oxide, SrO;
- SrO is then reduced to produce strontium.

(i) Suggest how strontium carbonate is converted into strontium oxide.

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[1]

(ii) Aluminium can be used to reduce strontium oxide.

Balance the equation below for this conversion.

..... SrO(s) + ... A*l*(s) → ..... Sr(s) + ... Al_2O_3(s)

[1]

(iii) A chemical company receives an order to supply 100 tonnes of strontium. The company needs to work out how much ore to process

The ore typically contains 2% by mass of $SrCO_3$.

Calculate the mass of ore that the company would need in order to produce 100 tonnes of strontium.

1 tonne = 10^6 g

[3]

(iv) Suggest how the company could minimise the environmental impact of strontium production from the ore.

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[1]

[Total 6 marks]

6. Iodine is extracted commercially from seawater with chlorine gas. Seawater contains very small quantities of dissolved iodide ions, which are oxidised to iodine by the chlorine gas.

(i) Write an ionic equation for the reaction that has taken place.

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[2]

(ii) Use your understanding of electronic structure to explain why chlorine is a stronger oxidising agent than iodine.

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[2]

[Total 4 marks]

7. Displacement reactions can be used to detect bromide ions in solution.

A student has a solution that contains bromide ions. The student carries out the following experiment.

Step 1

- She bubbles some chlorine gas through a sample of the solution.
- The mixture changes colour.

Step 2

- The student then adds an organic solvent, cyclohexane, to the mixture.
- She shakes the contents and allows the layers to separate.

(i) Write the **ionic** equation for the reaction that takes place in **step 1**.

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[1]

(ii) What colour does the cyclohexane layer turn in **step 2**?

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[1]

[Total 2 mark]

8. In this question one mark is available for the quality of spelling, punctuation and

grammar.

Chlorine gas was bubbled through an aqueous solution of bromide ions and also through an aqueous solution of iodide ions. An organic solvent was then added and each mixture was shaken.

- State what you would see in each case.
- Write equations for any chemical reactions that take place.
- State and explain the trend in reactivity shown by these observations.

[6]

Quality of Written Communication [1]

[Total 7 marks]

9. A student carried out an experiment using chlorine gas, $Cl_2(g)$.

The student bubbled chlorine through an aqueous solution of potassium bromide, KBr(aq). A reaction took place.

(i) What colour is the solution after the reaction has taken place?

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[1]

(ii) Write an equation for this reaction.

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[2]

(iii) This reaction takes place because chlorine has a stronger oxidising power than bromine. Explain why chlorine has a stronger oxidising power than bromine.

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[3]

[Total 6 marks]

10. Describe and explain the relative reactivity of the halogens chlorine, bromine and iodine in displacement reactions involving halides, using reactions on a test tube scale.

Include equations and observations in your answer.

[5]

Quality of Written Communication [1]

[Total 6 marks]

11. A student read about possible health problems arising from the use of common salt added to different foods. The student decided to compare the salt content of different foods using simple test-tube tests to test the chloride content.

Plan a simple qualitative experiment to compare the quantity of chloride ions in different foods. Comment on the validity of claiming that the chloride content is the same as the salt content.

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[Total 4 marks]

12. Aqueous silver nitrate was added to a solution of $CaCl_2$.

(i) State what you would expect to **see**.

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[1]

(ii) Write an ionic equation for this reaction.

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[1]

[Total 2 marks]