



GCE AS LEVEL CHEMISTRY

S21- B410

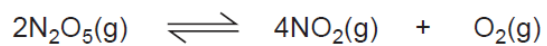
Assessment Resource F

Structure of Matter and Simple Reactions

1. What is the oxidation state of sulfur in the SO_4^{2-} ion? [1]

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2. Under certain conditions the following equilibrium exists.



(a) Write the expression for the equilibrium constant, K_c , for this equilibrium. [1]

$K_c =$

(b) State the unit, if any, for K_c in this equilibrium. [1]

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3. Water gas is a mixture of carbon monoxide and hydrogen that is made by passing steam over heated carbon.



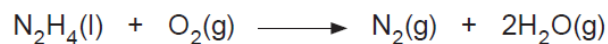
Calculate the atom economy of this process as a method for the production of hydrogen gas. [2]

Atom economy = %

4. Balance the following equation. [1]



5. Hydrazine, N_2H_4 , is a liquid that can be used as a rocket fuel. It reacts with oxygen in an exothermic reaction.



- (a) (i) A molecule of hydrazine contains single bonds only.

Draw a dot and cross diagram to show the arrangement of the electrons in hydrazine. You should show outer electrons only. [2]

- (ii) Suggest the bond angle for the $\text{H}-\text{N}-\text{H}$ bonds in hydrazine. Explain your suggestion. [3]

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- (b) Calculate the volume of nitrogen produced by the reaction of 20.0 cm^3 of liquid hydrazine with excess oxygen.

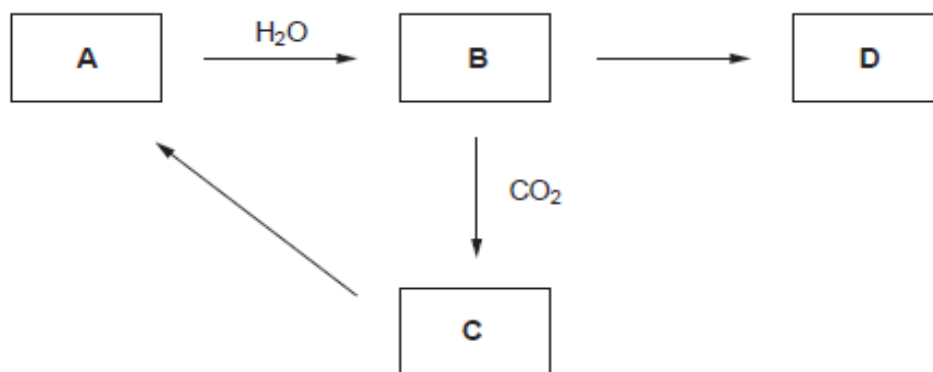
Assume that all measurements are taken at 273 K and 1 atm pressure, that the density of hydrazine is 1.02 g cm^{-3} and that the process has a 35% yield. [4]

Volume = dm^3

- (c) Methane also reacts with oxygen in an exothermic reaction and could be used as a rocket fuel. Apart from conservation of fossil fuel reserves, suggest an environmental advantage of using hydrazine. [1]

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6. Some reactions of compounds of the same s-block metal are shown below.



A is a compound that reacts with water to give an aqueous solution of the sparingly soluble compound B.

B reacts with carbon dioxide to give a white precipitate of compound C.

D is an aqueous solution that gives a white precipitate with aqueous silver nitrate.

(a) Give the names of compounds A to D. [4]

A

B

C

D

(b) Suggest a reagent that would convert B into D. [1]

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(c) State how the conversion of C into A could be carried out. [1]

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(d) Write the **ionic** equation for the conversion of **A** into **B**. Include state symbols. [2]

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(e) What would be observed, if anything, if aqueous sodium hydroxide were added dropwise and then to excess to solution **D**? [2]

Dropwise

Excess

(f) Suggest a test that would confirm the cation present in compounds **A** to **D**. Include the test and the expected result. [2]

Test

Result

7. (a) A compound of carbon, hydrogen and oxygen contains 40.0% carbon and 6.7% hydrogen by mass.

1.52g of the gaseous compound has a volume of 1.76 dm³ at a temperature of 150 °C and a pressure of 1 atm.

Use the data to determine the empirical formula and the molecular formula of this compound. You **must** show clearly how you carried out your calculations. [5]

Empirical formula

Molecular formula

- (b) (i) State what is meant by an acid. [1]

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- (ii) Describe how ammonia, NH₃, is able to act as a base. [2]

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- (iii) Calculate the pH of 0.43 mol dm⁻³ hydrochloric acid. [2]

pH =

(c) In the table below name the type of structure and bonding present in magnesium oxide, MgO, and chlorine dioxide, ClO₂. [2]

Compound	Structure	Bonding
MgO
ClO ₂