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**Answer ALL questions.**

1. (a) Complete the table.  
A, B, C and D are not the symbols for the elements.

Element	Number of electrons in outer shell	Formula of cation or anion usually formed
A	1	A <sup>+</sup>
B	3	
C	6	
D		D <sup>-</sup>

(3)

- (b) Name the following compounds.

(i) MgBr<sub>2</sub> ..... (1)

(ii) (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub> ..... (1)

(iii) FeSO<sub>4</sub> ..... (1)

(iv) CH<sub>3</sub>CH<sub>2</sub>Br ..... (1)

Q1

(Total 7 marks)



<p>2. Name each of the following processes.</p> <p>(a) A gas changes to a liquid ..... (1)</p> <p>(b) Hydrogen reacts with an alkene ..... (1)</p> <p>(c) An acid and an alkali react to form a solution of pH 7..... (1)</p> <p>(d) A liquid slowly disappears when left in an open dish ..... (1)</p> <p style="text-align: right;"><b>(Total 4 marks)</b></p>	Leave blank  <b>Q2</b> <input type="text"/>



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3. The following questions are about the Periodic Table of the elements. Insert the missing words and/or numbers.

(a) A horizontal row in the Periodic Table is known as a ..... (1)

(b) All the elements in Group 5 have .....  
in their outer shell. (1)

(c) Elements in the same group have ..... chemical properties. (1)

(d) The element with an Atomic Number of 24 is ..... (1)

(e) Two transition metals with the same Relative Atomic Mass are  
..... and ..... (1)

(f) The elements helium to radon are known as the ..... gases. (1)

(g) An atom of titanium contains ..... protons  
and ..... neutrons. (1)

(h) When an element in Group 4 combines with an element in Group 7,  
a ..... bond is formed. (1)

Q3

(Total 8 marks)



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4. Identify the element or compound that fits each of the following descriptions.

(a) The black solid formed when copper(II) hydroxide is heated.

.....  
(1)

(b) The colourless gas that is formed when oxygen and nitrogen react at high temperature.

.....  
(1)

(c) A hydrocarbon polymer in which the repeating unit has three carbon atoms.

.....  
(1)

(d) A yellow solid that has two allotropic forms.

.....  
(1)

(e) A blue solid that turns pink when water is added to it.

.....  
(1)

(f) A colourless gas that turns red litmus paper blue.

.....  
(1)

(g) A gas used in packet foods to keep the contents fresh.

.....  
(1)

(Total 7 marks)

Q4



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5. Calculate the number of:

(a) atoms in a molecule of  $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{COOH}$

.....  
(1)

(b) moles of hydrogen molecules that will react with three moles of propene,  $\text{C}_3\text{H}_6$

.....  
(1)

(c) moles of carbon dioxide formed by the complete combustion of one mole of pentane,  $\text{C}_5\text{H}_{12}$

.....  
(1)

(d) moles of steam formed by the complete combustion of one mole of ethane,  $\text{C}_2\text{H}_6$

.....  
(1)

(e) moles of oxygen atoms in two moles of potassium manganate(VII),  $\text{KMnO}_4$

.....  
(1)

(Total 5 marks)

Q5



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6. Complete the following statements about graphite and diamond.

Graphite is soft because it consists of layers of atoms held together in a hexagonal arrangement by ..... bonds but with ..... between the layers. The layers are able to ..... and this enables graphite to act as a lubricant.

It is a conductor of electricity because it has .....

Each carbon atom in diamond has four covalent bonds arranged in a ..... shape around the carbon and this makes the crystal very ..... It does not conduct electricity because all four outer shell electrons are .....

(Total 7 marks)

Q6

7

Turn over



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7. Give a test to distinguish between each of the following pairs of substances. In each case, describe what you would observe.

(a) Aqueous calcium chloride and aqueous calcium iodide.

Test: .....

.....

Observation for calcium chloride: .....

.....

Observation for calcium iodide: .....

.....

(3)

(b) Aqueous sodium carbonate and aqueous sodium nitrate.

Test: .....

.....

Observation for sodium carbonate: .....

.....

Observation for sodium nitrate: .....

.....

(3)

(c) Anhydrous copper(II) sulphate and anhydrous sodium sulphate.

Test: .....

.....

Observation for anhydrous copper(II) sulphate: .....

.....

Observation for anhydrous sodium sulphate: .....

.....

(3)

Q7

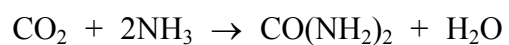
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8. Urea is a fertiliser that is made from carbon dioxide and ammonia.



(a) Calculate the mass of urea formed from 88 kg of carbon dioxide.

.....  
.....  
.....

(3)

(b) Calculate the percentage by mass of nitrogen in urea.

.....  
.....  
.....

(2)

(c) Urea is only slightly soluble in water. Give one advantage of using urea rather than ammonium nitrate as a fertiliser in tropical regions.

.....  
.....  
.....

(2)

Q8

(Total 7 marks)



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9. (a) When manganese(IV) oxide,  $\text{MnO}_2$ , is added to aqueous hydrogen peroxide,  $\text{H}_2\text{O}_2$ , oxygen is evolved.

(i) Write the equation for the reaction.

.....  
(1)

(ii) State the function of manganese(IV) oxide in this reaction.

.....  
(1)

(iii) Give a test, and the result, for oxygen.

.....  
.....  
(1)

(b) When manganese(IV) oxide is heated with concentrated hydrochloric acid, chlorine is evolved.

(i) Complete the equation for the reaction.

$\text{MnO}_2 + \dots \rightarrow \text{MnCl}_2 + \dots + \dots$   
(1)

(ii) State the function of manganese(IV) oxide in this reaction.

.....  
(1)

(iii) Give a test, and the result, for chlorine.

.....  
.....  
(1)

(iv) Give a characteristic property of a transition metal that the compounds  $\text{MnO}_2$  and  $\text{MnCl}_2$  illustrate.

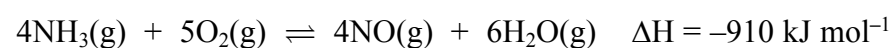
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(1)

Q9

(Total 7 marks)



10. The first stage in the production of nitric acid is the oxidation of ammonia.



(a) Complete the table to show what effect, if any, each of the changes in conditions will have on the position of equilibrium and on the rate at which equilibrium is reached.

Change in conditions	Effect on position of equilibrium	Effect on rate at which equilibrium is reached
Increasing the temperature		
Increasing the pressure		
Adding a catalyst		

(6)

(b) State the temperature and identify the catalyst used in industry for the above reaction.

Temperature: .....

Identity of catalyst: .....

(2)

(c) Explain why, once the reaction has started, no further heating is required.

.....

.....

(1)

Q10

(Total 9 marks)



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11. Identify, by name or formula, each of the substances labelled **A** to **H**.

- (a) A green powder **A** was heated and it turned into a black solid **B** and a colourless gas **C** that extinguished a burning splint.

**A** .....

**B** .....

**C** .....

(3)

- (b) When a small piece of a silvery metal **D** was dropped onto water, a lilac flame was seen. A colourless gas **E** and an alkaline solution **F** were produced.

**D** .....

**E** .....

**F** .....

(3)

- (c) When aqueous ammonia was added to a yellow solution **G**, a brown precipitate **H** was formed and a solution of ammonium sulphate remained.

**G** .....

**H** .....

(2)

Q11

(Total 8 marks)

13

Turn over



N 3 6 2 7 9 A 0 1 3 2 0

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12. (a) (i) Draw a displayed formula for  $C_4H_{10}$  and for  $C_4H_8$ . Use the formulae to explain the difference between *saturated* and *unsaturated* hydrocarbons in terms of the bonds present in the molecules.



Saturated hydrocarbon: .....

.....

Unsaturated hydrocarbon: .....

.....

(4)

- (ii) Draw a different displayed formula for  $C_4H_{10}$ . Use the two formulae for  $C_4H_{10}$  to explain what is meant by *isomerism*.

Isomerism: .....

.....

(2)



(b) (i) Give a test, and the observations, that would distinguish between  $C_4H_{10}$  and  $C_4H_8$ .

Test: .....

Observation for  $C_4H_{10}$ : .....

.....

Observation for  $C_4H_8$ : .....

.....

(3)

(ii) Write an equation for a reaction that occurs when the test is performed.

.....

(1)

(Total 10 marks)

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Q12

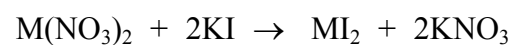


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13. A solution of a metal nitrate, represented as  $M(\text{NO}_3)_2$ , was mixed with aqueous potassium iodide, KI, and the precipitate,  $\text{MI}_2$ , formed was separated, dried and weighed. The results are shown in the table below.

Volume of $0.100 \text{ mol dm}^{-3}$ KI used/ $\text{cm}^3$	40.0	40.0	40.0	40.0	40.0
Volume of $0.100 \text{ mol dm}^{-3}$ $M(\text{NO}_3)_2$ used/ $\text{cm}^3$	10.0	15.0	20.0	25.0	30.0
Mass of precipitate, $\text{MI}_2$ , formed/g	0.461	0.692	0.922	0.922	0.922

The equation for the reaction is:



- (a) Write the ionic equation for the reaction, including state symbols.

.....  
(2)

- (b) Calculate the number of moles of KI in  $40.0 \text{ cm}^3$  of  $0.100 \text{ mol dm}^{-3}$  solution.

(1)

- (c) Calculate the number of moles of  $M(\text{NO}_3)_2$  in  $10.0 \text{ cm}^3$  of  $0.100 \text{ mol dm}^{-3}$  solution.

(1)





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(d) Explain why the mass of the precipitate initially increased but then became constant.

.....  
.....  
.....  
.....  
.....  
.....

(3)

(e) Given that 0.922 g of  $MI_2$  is 0.002 mol, calculate the relative atomic mass of M and identify the metal.

Calculation:

Identity of M:.....

(5)

Q13

(Total 12 marks)

**TOTAL FOR PAPER: 100 MARKS**

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