

Answer ALL the questions.

1. Complete the table.

Name of compound	Formula of compound
calcium bromide	
	NH_4NO_3
sodium sulphite	
copper(I) oxide	
	PbO_2
iron(III) sulphate	

(Total 6 marks)

Q1



2. Complete the following statements by inserting the missing colours.

- (a) When water is added to anhydrous cobalt chloride, it turns
 (1)
- (b) When iodine is heated, it forms a vapour. (1)
- (c) The element whose atomic number is 16 is a solid at room temperature. (1)
- (d) Ammonia and hydrogen chloride react to form a solid. (1)
- (e) When nitrogen monoxide is mixed with air, a gas is formed. (1)
- (f) When calcium is burned in oxygen, the product is a solid. (1)

(Total 6 marks)

Q2



3. Identify, by name or formula, an element or compound that fits each of the descriptions.

(a) A gas molecule containing three atoms that is present in dry air.

..... (1)

(b) A white solid that is formed when magnesium carbonate is heated.

..... (1)

(c) The precipitate formed when aqueous potassium carbonate is added to aqueous calcium nitrate.

..... (1)

(d) A diatomic gas molecule that consists of two different atoms covalently bonded together.

..... (1)

(e) A metal that will burn with a brick red flame.

..... (1)

(f) A colourless solution with a pH of 14.

..... (1)

(g) The gas evolved when potassium nitrate is heated.

..... (1)

(Total 7 marks)

Q3



4. Complete the following statements, using the Periodic Table where necessary.

(a) The electron configuration for phosphorus is (1)

(b) The element that is in Group 6 and Period 4 is (1)

(c) The number of electrons in the outer shell of tin (atomic number = 50) is (1)

(d) The atom with an electron configuration 2,8,8 is (1)

(e) A Group 1 element that is more reactive than potassium is (1)

(f) The type of bond formed between strontium (atomic number 38) and bromine is (1)

(Total 6 marks)

Q4



5. Give the number of:

(a) atoms in a molecule of $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$

..... (1)

(b) single covalent bonds in the alkene C_4H_8

..... (1)

(c) protons in an atom of calcium

..... (1)

(d) moles of ethane needed to form four moles of carbon dioxide on complete combustion

..... (1)

(e) sulphate ions that ionically bond to two aluminium ions in aluminium sulphate

..... (1)

(f) moles of nitric acid in 250 cm^3 of nitric acid of concentration $0.500 \text{ mol dm}^{-3}$

..... (1)

(Total 6 marks)

Q5



6. (a) Draw diagrams to show the arrangement and spacing of particles in the three states of matter. Use a small circle to represent a particle.



solid



liquid



gas

(6)

(b) Explain why it requires less energy to convert one mole of ice to water than to convert one mole of water to steam.

.....

.....

.....

.....

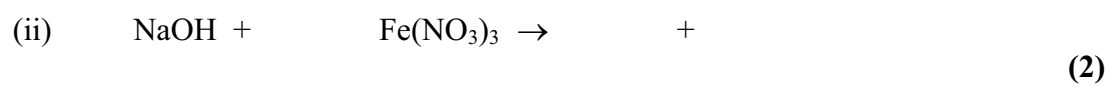
(2)

Q6

(Total 8 marks)



7. (a) Complete and balance the equations.



(b) Write the **ionic** equation for the neutralisation of an alkali with an acid.

..... (1)

Q7

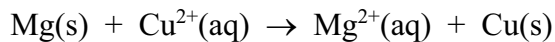
(Total 7 marks)



8. (a) What is meant by the term **oxidation**?

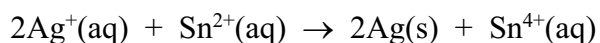
..... (1)

(b) (i) State with a reason which species has been oxidised.



.....
 (1)

(ii) State with a reason which species has been reduced.



.....
 (1)

(c) Give **two** observations that could be made during the reaction in (b)(i).

.....

 (2)

(Total 5 marks)

Q8



9. (a) Draw diagrams to show the shapes of the following molecules using a line to represent a covalent bond. Do not show electron arrangements.

(i) Ammonia

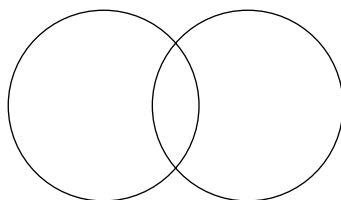
(2)

(ii) Carbon dioxide

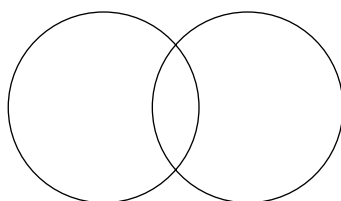
(2)

(b) (i) Complete the diagrams to show the electron arrangements in nitrogen and oxygen.

Nitrogen, N₂



Oxygen, O₂



(4)

(ii) Explain in terms of bonding why nitrogen is much less reactive than oxygen.

.....

(2)

(Total 10 marks)

Q9



10. Atoms of iron and nickel can be represented as ${}^{56}_{26}\text{Fe}$, ${}^{58}_{26}\text{Fe}$ and ${}^{58}_{28}\text{Ni}$.

(a) (i) Give **two** ways in which the atomic structures of the atoms of iron are the same.

.....

.....

(2)

(ii) Give **one** way in which the atomic structures of the atoms of iron are different.

.....

(1)

(iii) What name is given to these types of atoms of iron?

.....

(1)

(b) Give **one** way in which the nucleus of the atom of nickel is the same as the nucleus of one of the atoms of iron.

.....

(1)

(c) Explain why the chemical reactions of the two different atoms of iron are identical.

.....

.....

(1)

(d) Explain why both iron and nickel are good conductors of electricity.

.....

.....

.....

(2)

(Total 8 marks)

Q10



11. (a) An unsaturated compound **X** has the following percentage composition by mass.

$$C = 38.4\% \quad H = 4.8\% \quad Cl = 56.8\%$$

(i) Show that the empirical formula is C_2H_3Cl .

(2)

(ii) The relative molecular mass is 62.5. Use this to determine the molecular formula of **X**.

(1)

(iii) Draw the displayed formula for **X**.

(1)

(iv) Draw a section of the polymer chain formed if **X** were to be polymerised.

(1)

(v) State **three** conditions used in industry in the polymerisation of an alkene.

.....

.....

.....

(3)



- (b) A section of a polymer chain is shown below. Write the structural formulae of the two monomers.



Monomer 1

Monomer 2

(2)

Q11

(Total 10 marks)

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12. A student was asked to perform titrations to determine the relative molecular mass, and hence the identity, of a white solid which was known to be one of the following two organic acids.



The student dissolved a weighed amount of the acid in water in a conical flask and titrated it against sodium hydroxide of concentration $0.400 \text{ mol dm}^{-3}$. Phenolphthalein indicator was used to obtain an accurate end-point. The results obtained are recorded in the table.

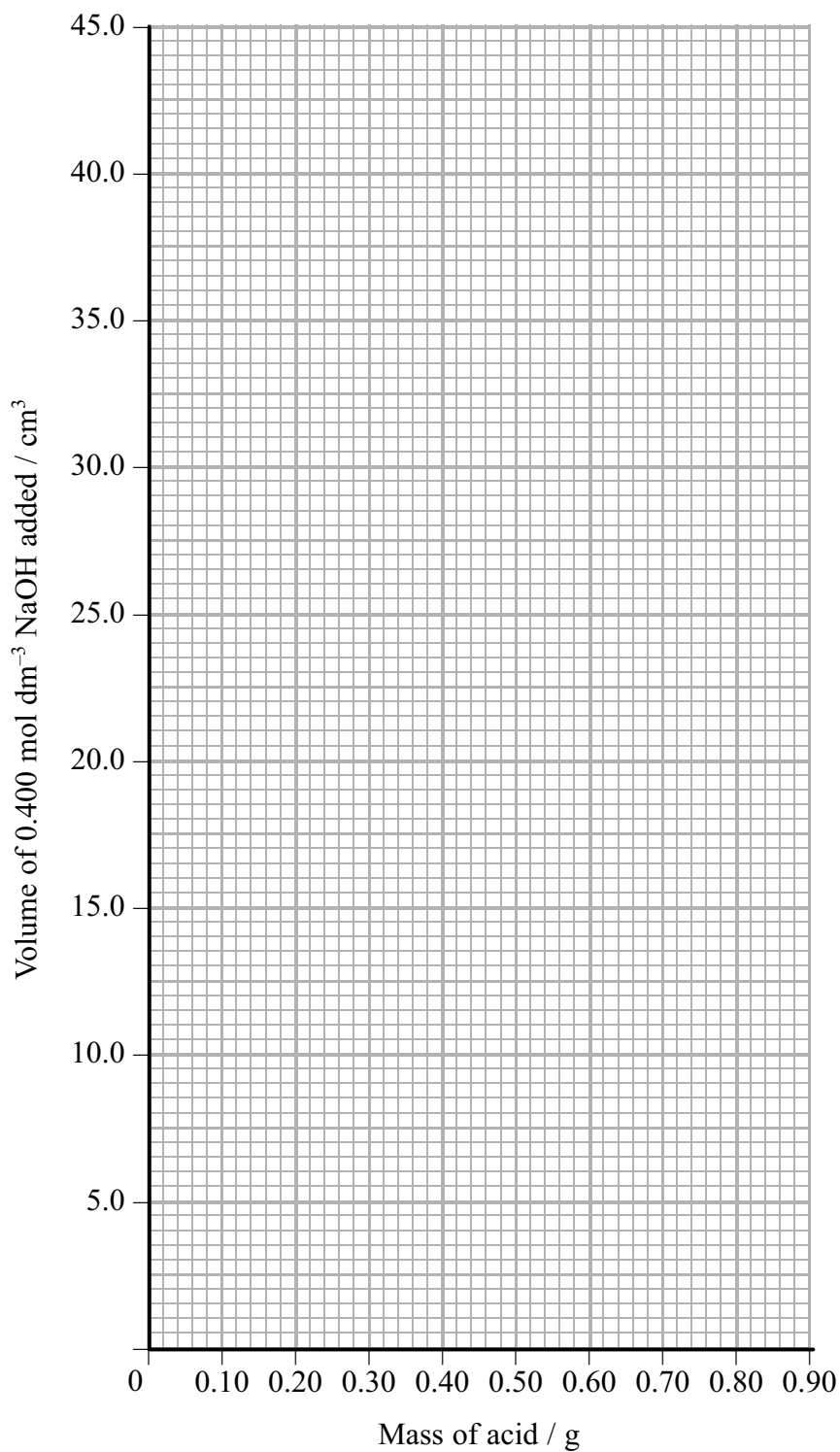
Mass of acid used / g	Volume of NaOH used / cm^3
0.25	12.0
0.40	15.0
0.46	22.1
0.65	31.3
0.85	40.9

- (a) Give the colour of phenolphthalein at the end-point.

.....
(1)



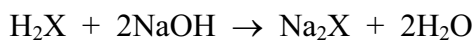
- (b) Plot these results on the grid below. The position of one of the points indicates a poor result that should be ignored; on the grid draw a circle around that point. Using a ruler, draw a straight line of best fit through the other four points.



(4)



(c) The equation for the reaction can be written using H_2X to represent the acid.



(i) Use the graph to find the mass of acid that would give a titration value of 25.0 cm^3 of sodium hydroxide of concentration $0.400 \text{ mol dm}^{-3}$.

.....
(1)

(ii) Use the mass of acid in part (i) to find the relative molecular mass of the acid, H_2X .

Moles of NaOH in 25.0 cm^3 :

Moles of acid used:

Relative molecular mass of H_2X :

(4)

(iii) Calculate the relative molecular mass of each of the organic acids A and B and hence identify the unknown acid.

$M_r(\text{A}) = \dots\dots\dots$

$M_r(\text{B}) = \dots\dots\dots$

Unknown acid is

(2)

Q12

(Total 12 marks)

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13. Give a simple test to distinguish between each of the following pairs of substances. State what would be observed for each substance.

(a) Sodium chloride and potassium chloride.

Test

Observation for sodium chloride

.....

Observation for potassium chloride

.....

(3)

(b) Ammonia and sulphur dioxide.

Test

Observation for ammonia

.....

Observation for sulphur dioxide

.....

(3)

(c) Magnesium oxide and magnesium carbonate.

Test

Observation for magnesium oxide

.....

.....

Observation for magnesium carbonate

.....

.....

(3)

Q13

(Total 9 marks)

TOTAL FOR PAPER: 100 MARKS

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