PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



EXAM QUESTION PACK

TOPIC 1: KEY CONCEPTS IN CHEMISTRY (PACK 1)

SCORE	PERCENTAGE
/64	%

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Q1.

An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.

(2)

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Q2.

An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.

(2)

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Q3.

(a) An acid can be reacted with a base in a titration experiment.

(i) State the name of the type of reaction when an acid reacts with a base.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The general equation for the reaction of an acid with a base is

(1)

☒ **A** acid + base → alkali + water

☒ **B** acid + base → salt + carbon dioxide

☒ **C** acid + base → salt + water + hydrogen

☒ **D** acid + base → salt + water

(b) A solution of sodium hydroxide is prepared.

The mass of a container with solid sodium hydroxide is determined.
The sodium hydroxide is transferred to a flask.
The mass of the empty container is determined.
The sodium hydroxide is dissolved in water and the volume made up to 2 dm^3.

The results are
mass of container + solid sodium hydroxide = 17.12g
mass of empty container = 7.02g

The results are used to calculate the concentration of the sodium hydroxide solution.

(i) Calculate the mass of solid sodium hydroxide transferred to the flask.

(1)

.....

mass of solid sodium hydroxide = ... g

(ii) Calculate the concentration of the sodium hydroxide solution in g dm^{-3}.

(1)

.....

.....

concentration of sodium hydroxide solution = ... g dm^{-3}

Q4.

(a) An acid can be reacted with a base in a titration experiment.

(i) State the name of the type of reaction when an acid reacts with a base.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The general equation for the reaction of an acid with a base is

(1)

☒ **A** acid + base → alkali + water

☒ **B** acid + base → salt + carbon dioxide

☒ **C** acid + base → salt + water + hydrogen

☒ **D** acid + base → salt + water

(b) A solution of sodium hydroxide is prepared.

The mass of a container with solid sodium hydroxide is determined.
The sodium hydroxide is transferred to a flask.
The mass of the empty container is determined.
The sodium hydroxide is dissolved in water and the volume made up to 2 dm^3.

The results are
mass of container + solid sodium hydroxide = 17.12g
mass of empty container = 7.02g

The results are used to calculate the concentration of the sodium hydroxide solution.

(i) Calculate the mass of solid sodium hydroxide transferred to the flask.

(1)

.....

mass of solid sodium hydroxide = ... g

(ii) Calculate the concentration of the sodium hydroxide solution in g dm^{-3}.

(1)

.....

.....

concentration of sodium hydroxide solution = ... g dm^{-3}

Q5.

A titration is to be carried out to find the concentration of a solution of sodium hydroxide.

The sodium hydroxide solution is titrated with dilute sulfuric acid.

The available apparatus includes a burette, a pipette, a funnel, a conical flask and an indicator.

(a) State one safety precaution that must be taken when using sodium hydroxide solution and dilute sulfuric acid.

(1)

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.....

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(b) The sodium hydroxide solution is made by dissolving 4.3 g of sodium hydroxide in water and making the solution up to 250 cm^3 with water.

Calculate the concentration of the solution in g dm^{-3}.

(2)

concentration = ... g dm^{-3}

(c) Write the balanced equation for the reaction of dilute sulfuric acid, H_2SO_4, with sodium hydroxide.

(2)

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(d) The results of titrations to determine how much of an acid is required to neutralise a given volume of an alkaline solution are shown in Figure 14.

	titration 1	titration 2	titration 3	titration 4
final burette reading (cm^3)	27	27.40	29.20	29.30
initial burette reading (cm^3)	0	2.10	4.00	3.50
volume of acid used (cm^3)	27	25.30	25.20	25.80

Figure 14

Two of the titrations in Figure 14 should **not** be used to calculate the mean volume of acid required.

Identify each titration and give a reason why it should not be used in the calculation of the mean.

(2)

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(Total for question = 7 marks)

Q6.

Figure 7 shows the molecular formulae and boiling points of four alkanes.

alkane	molecular formula	boiling point in °C
propane	C_3H_8	–42
butane	C_4H_{10}	0
pentane	C_5H_{12}	36
hexane	C_6H_{14}	69

Figure 7

(i) Describe how the boiling points of these alkanes change as the numbers of carbon atoms in one of their molecules change.

(1)

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(ii) Calculate the relative formula mass of a molecule of propane, C_3H_8.

(relative atomic masses: C = 12, H = 1)

(1)

.....

relative formula mass = ...

(iii) Propane reacts with excess oxygen to form carbon dioxide and water.

Write the word equation for this reaction.

(2)

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(iv) Explain a problem caused by the incomplete combustion of propane.

(2)

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(Total for question = 6 marks)

Q7.

(a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

$$\text{magnesium oxide} + \text{sulfuric acid} \rightarrow \text{magnesium sulfate} + \text{water}$$

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

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(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

.....

(c) Samples of tap water from city A and city B were investigated.

Each sample of water was treated as follows.
The mass of an empty evaporating basin was determined.
500 cm^3 of tap water was added and evaporated to dryness.

The mass of the evaporating basin and remaining solid was determined.

Here are the results.

	city A	city B
mass of evaporating basin / g	261.500	258.450
mass of evaporating basin + solid / g	261.611	258.515
mass of solid / g	0.111	
concentration of dissolved solid in tap water / g dm^{-3}	0.222	

Calculate the concentration, in g dm–3, of dissolved solid in the tap water from city B.

(2)

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concentration of solid = ... g dm^{-3}

*(d) Some dissolved solids cause hardness in water.
Hard water can be softened.
Water hardness can be temporary hardness or permanent hardness.
Not all softening processes remove both types of hardness.

Describe and explain different methods of softening water, indicating the type of hardness each method removes.

(6)

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(Total for Question = 12 marks)

Q8.

(a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

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(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

.....

(c) Samples of tap water from city A and city B were investigated.

Each sample of water was treated as follows.
The mass of an empty evaporating basin was determined.
500 cm^3 of tap water was added and evaporated to dryness.

The mass of the evaporating basin and remaining solid was determined.

Here are the results.

	city A	city B
mass of evaporating basin / g	261.500	258.450
mass of evaporating basin + solid / g	261.611	258.515
mass of solid / g	0.111	
concentration of dissolved solid in tap water / g dm^{-3}	0.222	

Calculate the concentration, in g dm–3, of dissolved solid in the tap water from city B.

(2)

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concentration of solid = ... g dm^{-3}

*(d) Some dissolved solids cause hardness in water.
Hard water can be softened.
Water hardness can be temporary hardness or permanent hardness.
Not all softening processes remove both types of hardness.

Describe and explain different methods of softening water, indicating the type of hardness each method removes.

(6)

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(Total for Question = 12 marks)

Q9.

Argon is in group 0 of the periodic table.

Identify, using the periodic table on the back cover of this paper, which of these elements is in the same period as argon.

(1)

☒ **A** bromine

☒ **B** iron

☒ **C** magnesium

☒ **D** xenon

(Total for question = 1 mark)

Q10.

Sodium fluoride is an ionic compound.

(i) Describe how a sodium atom and a fluorine atom interact to form a sodium ion, Na^+, and a fluoride ion, F^-.

(2)

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(ii) Explain why sodium fluoride is able to conduct electricity when it is molten but not when it is solid.

(2)

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(Total for question = 4 marks)

Q11.

Sodium fluoride is an ionic compound.

(i) Describe how a sodium atom and a fluorine atom interact to form a sodium ion, Na^+, and a fluoride ion, F^-.

(2)

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(ii) Explain why sodium fluoride is able to conduct electricity when it is molten but not when it is solid.

(2)

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(Total for question = 4 marks)

Q12.

Each element has an atomic number.

(i) State what is meant by **atomic number.**

(1)

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.....

(ii) The atomic number of boron is 5.
Boron exists as two isotopes boron-10 and boron-11.

Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

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Q13.

Each element has an atomic number.

(i) State what is meant by **atomic number.**

(1)

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.....

(ii) The atomic number of boron is 5.
Boron exists as two isotopes boron-10 and boron-11.

Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

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Q14.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The particles in atoms are electrons, neutrons and protons.

The mass of an electron is

(1)

☒ **A** greater than the mass of a neutron

☒ **B** the same as the mass of a proton

☒ **C** smaller than the mass of a proton

☒ **D** the same as the mass of a neutron

(b) The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

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(c) Sulfur and oxygen are both in group 6 of the periodic table.

Explain, in terms of their electronic configurations, why they are both in group 6.

(2)

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(d) An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.

(2)

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(e) Phosphorus oxide is a compound that contains covalent bonds.

(i) Describe what is meant by a **covalent bond.**

(2)

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(ii) The formula of a molecule of phosphorus oxide is P_4O_{10}

Give the empirical formula of this oxide.

(1)

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(Total for Question = 10 marks)

Q15.

(a) The table shows the number of electrons, neutrons and protons in particles P, Q, R, S, T and V.

particle	number of		
	electrons	neutrons	protons
P	1	0	1
Q	3	4	3
R	8	8	8
S	13	14	13
T	18	16	16
V	18	20	20

(i) Which particle is a negatively charged ion?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** P

☒ **B** S

☒ **C** T

☒ **D** V

(ii) Which particles are atoms of metals?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** P and R

☒ **B** Q and R

☒ **C** Q and S

☒ **D** Q, S and V

(b) Each element has an atomic number.

(i) State what is meant by **atomic number.**

(1)

.....

.....

(ii) The atomic number of boron is 5.
Boron exists as two isotopes boron-10 and boron-11.

Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

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(c) (i) Explain what is meant by the term relative atomic mass.

(2)

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(ii) A sample of boron contains
19.7% of boron-10.
80.3% of boron-11.

Use this information to calculate the relative atomic mass of boron.

(3)

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(Total for Question = 10 marks)

Q16.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The particles in atoms are electrons, neutrons and protons.

The mass of an electron is

(1)

☒ **A** greater than the mass of a neutron

☒ **B** the same as the mass of a proton

☒ **C** smaller than the mass of a proton

☒ **D** the same as the mass of a neutron

(b) The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

.....

.....

.....

.....

(c) Sulfur and oxygen are both in group 6 of the periodic table.

Explain, in terms of their electronic configurations, why they are both in group 6.

(2)

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.....

(d) An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.

(2)

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.....

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.....

(e) Phosphorus oxide is a compound that contains covalent bonds.

(i) Describe what is meant by a **covalent bond.**

(2)

.....

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.....

(ii) The formula of a molecule of phosphorus oxide is P_4O_{10}

Give the empirical formula of this oxide.

(1)

.....

(Total for Question = 10 marks)

Q17.

(a) The table shows the number of electrons, neutrons and protons in particles P, Q, R, S, T and V.

particle	number of		
	electrons	neutrons	protons
P	1	0	1
Q	3	4	3
R	8	8	8
S	13	14	13
T	18	16	16
V	18	20	20

(i) Which particle is a negatively charged ion?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** P

☒ **B** S

☒ **C** T

☒ **D** V

(ii) Which particles are atoms of metals?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** P and R

☒ **B** Q and R

☒ **C** Q and S

☒ **D** Q, S and V

(b) Each element has an atomic number.

(i) State what is meant by **atomic number.**

(1)

.....

.....

(ii) The atomic number of boron is 5.
Boron exists as two isotopes boron-10 and boron-11.

Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

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(c) (i) Explain what is meant by the term relative atomic mass.

(2)

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.....

(ii) A sample of boron contains
19.7% of boron-10.
80.3% of boron-11.

Use this information to calculate the relative atomic mass of boron.

(3)

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(Total for Question = 10 marks)

Q18.

(a) Complete the table to show the relative mass of a neutron and of an electron.

(2)

particle	relative mass
proton	1
neutron	
electron	

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

An atom has no overall charge because it contains

(1)

☒ **A** more protons than electrons

☒ **B** the same number of electrons and protons

☒ **C** the same number of electrons and neutrons

☒ **D** more neutrons than electrons

(c) The atomic number of lithium is 3.
The mass number of an atom of lithium is 7.

State the name and number of each of the particles in the nucleus of this atom.

(2)

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Q19.

(a) Complete the table to show the relative mass of a neutron and of an electron.

(2)

particle	relative mass
proton	1
neutron	
electron	

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

An atom has no overall charge because it contains

(1)

☒ **A** more protons than electrons

☒ **B** the same number of electrons and protons

☒ **C** the same number of electrons and neutrons

☒ **D** more neutrons than electrons

(c) The atomic number of lithium is 3.
The mass number of an atom of lithium is 7.

State the name and number of each of the particles in the nucleus of this atom.

(2)

.....

.....

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Q20.

The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

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Q21.

The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

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.....

Q22.

The balanced equation for this reaction is

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

(i) In another experiment, 0.1 moles of hydrochloric acid, HCl, were reacted with 0.1 g of magnesium ribbon.

Calculate the number of moles of magnesium, Mg, in the 0.1 g sample of magnesium ribbon.

(relative atomic mass: Mg = 24)

(1)

.....

.....

.....

number of moles = ...

(ii) In a further experiment, 0.5 mol of hydrochloric acid, HCl, were mixed with 0.5 mol of magnesium, Mg.

Use the equation to show that, in this experiment, the magnesium is in excess.

(1)

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.....

(Total for question = 2 marks)

Q23.

The elements beryllium, magnesium, calcium, strontium and barium are in group 2 of the periodic table.

Barium has a melting point of 714 °C.

Explain, in terms of structure and bonding, why barium has a high melting point.

(3)

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(Total for question = 3 marks)

Q24.

(a) Barium sulfate contains

barium ions, Ba^{2+}
sulfate ions, SO_4^{2-}

(i) Give the formula of barium sulfate.

(1)

.....

(ii) Give the meaning of the term **ion.**

(1)

.....

.....

(b) This is an X-ray photograph of part of a patient's body.
Before the photograph was taken a suspension of barium sulfate was introduced into his body to show the required part.



Source: andi-sheba.blogspot.com

Many barium salts are toxic.
Barium sulfate is insoluble in water.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

.....

.....

.....

*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate.
The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

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(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

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(Total for Question = 12 marks)

Q25.

(a) Barium sulfate contains

barium ions, Ba^{2+}
sulfate ions, SO_4^{2-}

(i) Give the formula of barium sulfate.

(1)

.....

(ii) Give the meaning of the term **ion.**

(1)

.....

.....

(b) This is an X-ray photograph of part of a patient's body.
Before the photograph was taken a suspension of barium sulfate was introduced into his body to show the required part.



Source: andi-sheba.blogspot.com

Many barium salts are toxic.
Barium sulfate is insoluble in water.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

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*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate.
The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

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(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

.....

(Total for Question = 12 marks)

Q26.

Nitrogen and oxygen are present in the air.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Oxygen has a low boiling point because there are

(1)

☒ **A** weak covalent bonds between the oxygen atoms

☒ **B** weak covalent bonds between the oxygen molecules

☒ **C** weak forces of attraction between the oxygen atoms

☒ **D** weak forces of attraction between the oxygen molecules

Q27.

Nitrogen and oxygen are present in the air.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Oxygen has a low boiling point because there are

(1)

☒ **A** weak covalent bonds between the oxygen atoms

☒ **B** weak covalent bonds between the oxygen molecules

☒ **C** weak forces of attraction between the oxygen atoms

☒ **D** weak forces of attraction between the oxygen molecules

Q28.

Bonding and separation techniques

(a) The diagram shows the structure of diamond.



(i) Describe what each ● represents.

(2)

.....

.....

(ii) State the type of bonding in the diamond structure.

(1)

.....

(b) Give the name of the process used to obtain oxygen from liquid air.

(2)

.....

.....

(c) A colouring in some sweets was analysed using paper chromatography.

One of the dyes in the colouring moved 2 cm up the paper while the solvent moved 8 cm.

What is the R_f value of this dye?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 0.25

☒ **B** 2

☒ **C** 4

☒ **D** 6

*(d) Here is some information about magnesium, oxygen and magnesium oxide.

The electronic configuration of magnesium atoms is 2.8.2
The electronic configuration of oxygen atoms is 2.6
Magnesium oxide is an ionic compound.

When magnesium ribbon is heated, it reacts with oxygen from the air to form magnesium oxide, MgO.

Describe how the reaction can be carried out, including an explanation of what happens to the magnesium and oxygen atoms when they form magnesium oxide.

(6)

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(Total for question = 12 marks)

Q29.

Bonding and separation techniques

(a) The diagram shows the structure of diamond.



(i) Describe what each ● represents.

(2)

.....

.....

(ii) State the type of bonding in the diamond structure.

(1)

.....

(b) Give the name of the process used to obtain oxygen from liquid air.

(2)

.....

.....

(c) A colouring in some sweets was analysed using paper chromatography.

One of the dyes in the colouring moved 2 cm up the paper while the solvent moved 8 cm.

What is the R_f value of this dye?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 0.25

☒ **B** 2

☒ **C** 4

☒ **D** 6

*(d) Here is some information about magnesium, oxygen and magnesium oxide.

The electronic configuration of magnesium atoms is 2.8.2
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Magnesium oxide is an ionic compound.

When magnesium ribbon is heated, it reacts with oxygen from the air to form magnesium oxide, MgO.

Describe how the reaction can be carried out, including an explanation of what happens to the magnesium and oxygen atoms when they form magnesium oxide.

(6)

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(Total for question = 12 marks)

Q30.

Chlorine exists as diatomic molecules.

In a molecule, two chlorine atoms are joined by a covalent bond.

(i) Describe what is meant by a **covalent bond**.

(2)

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.....

(ii) Explain why chlorine is a gas, rather than a liquid, at room temperature.

(2)

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.....

(Total for question = 4 marks)

Q31.

Chlorine exists as diatomic molecules.

In a molecule, two chlorine atoms are joined by a covalent bond.

(i) Describe what is meant by a **covalent bond**.

(2)

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.....

(ii) Explain why chlorine is a gas, rather than a liquid, at room temperature.

(2)

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.....

(Total for question = 4 marks)

Q32.

Lithium, sodium and potassium are metals in group 1 of the periodic table.

When heated calcium burns in air to form calcium oxide.

(i) Write the word equation for this reaction.

(2)

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(ii) In an experiment to determine the empirical formula for calcium oxide, 1.05 g of calcium combined with 0.42 g of oxygen.

Calculate the empirical formula of the calcium oxide.
(relative atomic masses: Ca = 40, O = 16)

You must show your working.

(3)

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empirical formula of calcium oxide = ...

(Total for question = 5 marks)

Q33.

(a) Calcium nitrate solution reacts with sodium carbonate solution.
The products are calcium carbonate and another salt.

Write the word equation for this reaction.

(2)

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.....

(b) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The colour produced in a flame test by calcium ions is

(1)

☒ **A** green

☒ **B** lilac

☒ **C** orange-red

☒ **D** yellow

(ii) Describe how a flame test is carried out on a solid.

(2)

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.....

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.....

(c) If calcium carbonate is heated strongly, it decomposes.

$$CaCO_3 \rightarrow CaO + CO_2$$

If 100 g of calcium carbonate is heated a calculation shows that 44 g carbon dioxide should be formed.

(i) In an experiment 100 g of calcium carbonate was heated and only 40 g carbon dioxide was formed.

Calculate the percentage yield of carbon dioxide in this reaction.

(2)

.....

.....

percentage yield of carbon dioxide =.....%

(ii) Suggest a reason why only 40 g of carbon dioxide was formed in the experiment.

(1)

.....

.....

.....

(d) Complete the sentence by putting a cross (☒) in the box next to your answer.

Ionic compounds

(1)

☒ **A** conduct electricity when solid

☒ **B** do not conduct electricity when molten

☒ **C** have low boiling points

☒ **D** have high melting points

(Total for Question = 9 marks)