cookie

Practice paper

GCSE Chemistry Higher, practice paper 1 (AQA style)

In the style of AQA GCSE Chemistry (8462) Paper 1 Higher

Practice paper written by cookie in the style of AQA GCSE Chemistry (8462) Paper 1 Higher. Not an AQA paper; not affiliated with or endorsed by AQA.

Time allowed: 1 hour 45 minutes

Total marks: 100

Name _____

Instructions

- This is a practice paper written by cookie in the style of AQA GCSE Chemistry Paper 1 Higher. It is not an AQA paper.
- Topics: atomic structure and the periodic table; bonding, structure and the properties of matter; quantitative chemistry; chemical changes; energy changes.
- Answer all questions in the spaces provided.
- You may use a calculator.
- In all calculations, show clearly how you work out your answer.
- Relative atomic masses (Ar) and other data are given in the questions where you need them.
- The maximum mark for this paper is 100. The marks for each part are shown in brackets.
- Questions marked with 6 marks are extended responses: you will be assessed on your ability to give a clear, logically structured answer.

Information

- The marks for each question are shown in brackets.
- The maximum mark for this paper is 100.

Do it online, timed and marked:
cookie.education/past-papers/gcse/cookie/chemistry-aqa-style

Answer all questions in the spaces provided.

0 1 This question is about atoms and isotopes.

Isotope	Mass number	Percentage abundance (%)
gallium-69	69	60.1
gallium-71	71	39.9

0 1 . 1 Which statement about the nucleus of an atom is correct? Choose one answer.

A It contains protons and electrons. ☐

B Its radius is less than 1/10 000 of the radius of the atom. ☐

C It has an overall negative charge. ☐

D It takes up most of the volume of the atom. ☐

[1 mark]

0 1 . 2 The table shows the two naturally occurring isotopes of gallium. Calculate the relative atomic mass (Ar) of gallium. Give your answer to 1 decimal place.

[2 marks]

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0 1 . 3 Gallium has atomic number 31. Give the number of protons, neutrons and electrons in one Ga^{3+} ion formed from gallium-71.

[3 marks]

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0 1 . 4 Scientists used the plum pudding model of the atom before the nuclear model. Give two differences between the plum pudding model and the nuclear model.

[2 marks]

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0 2 This question is about elements in Group 1 and Group 7 of the periodic table. The table shows the melting points of some Group 1 elements.

Element	Melting point in °C
lithium	181
sodium	98
potassium	63
rubidium	39
caesium	?

0 2 . 1 Predict the melting point of caesium.

[1 mark]

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0 2 . 2 Potassium reacts with water to produce potassium hydroxide solution and hydrogen gas. Write a balanced symbol equation for this reaction. Include state symbols.

[3 marks]

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0 2 . 3 Potassium is more reactive than sodium. Explain why. Answer in terms of electrons.

[3 marks]

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0 2 . 4 A student adds chlorine water to potassium bromide solution. The solution changes from colourless to orange. Write the ionic equation for this reaction.

[2 marks]

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0 2 . 5 Mendeleev left gaps in his periodic table. Gallium was discovered a few years after his table was published. Explain how the discovery of gallium helped scientists to accept Mendeleev's periodic table.

[2 marks]

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0 3 This question is about structure and bonding. The table shows information about four substances, A, B, C and D.

Substance	**Melting point in °C**	**Conducts electricity when solid?**	**Conducts electricity when molten?**
A	1650	no	no
B	−95	no	no
C	801	no	yes
D	1085	yes	yes

0 3 . 1 Which substance, A, B, C or D, has a giant covalent structure? Give a reason for your answer.

[2 marks]

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0 3 . 2 Magnesium reacts with oxygen to form magnesium oxide, MgO. The electronic structure of magnesium is 2,8,2 and of oxygen is 2,6. Describe what happens when a magnesium atom reacts with an oxygen atom. Answer in terms of electrons.

[4 marks]

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0 3 . 3 A sun cream contains cube-shaped nanoparticles of titanium dioxide. Each nanoparticle has sides of 40 nm. Calculate the surface area to volume ratio of one nanoparticle.

[3 marks]

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0 3 . 4 Diamond and graphite are both forms of carbon. Compare the structure and bonding in diamond and graphite. Use your answer to explain the differences in their hardness and electrical conductivity.

[6 marks]

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0 4 This question is about calcium nitrate, Ca(NO3)2. Relative atomic masses (Ar): N = 14, O = 16, Ca = 40.

0 4 . 1 Calculate the relative formula mass (Mr) of calcium nitrate, Ca(NO3)2.

[2 marks]

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0 4 . 2 When calcium nitrate is heated, it decomposes: 2Ca(NO3)2(s) → 2CaO(s) + 4NO2(g) + O2(g). A student heats 8.20 g of calcium nitrate until the mass stops changing. Calculate the mass of calcium oxide produced.

[3 marks]

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0 4 . 3 Calculate the total volume of gas produced at room temperature and pressure when 8.20 g of calcium nitrate decomposes. One mole of any gas occupies 24 dm^3 at room temperature and pressure.

[3 marks]

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0 5 Iron can be produced by reducing iron(III) oxide with carbon monoxide: Fe2O3 + 3CO → 2Fe + 3CO2. Relative formula masses (Mr): Fe2O3 = 160, CO = 28, CO2 = 44. Relative atomic mass (Ar): Fe = 56.

0 5 . 1 Calculate the percentage atom economy for producing iron in this reaction. Give your answer to 3 significant figures.

[3 marks]

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0 5 . 2 In a test, 40.0 kg of iron(III) oxide produced 23.8 kg of iron. Calculate the percentage yield of iron.

[4 marks]

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0 5 . 3 A student reacts aluminium with chlorine to form aluminium chloride, AlCl3. 0.54 g of aluminium reacts with 2.13 g of chlorine, Cl2, to form 2.67 g of aluminium chloride. Relative atomic masses (Ar): Al = 27, Cl = 35.5. Use these masses to work out the balanced symbol equation for the reaction. You must show your working.

[4 marks]

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0 6 This question is about acids and salts.

0 6 . 1 Which equation represents the reaction that happens when any acid is neutralised by an alkali? Choose one answer.

A $H^+(aq) + OH^-(aq) \rightarrow H2O(l)$ ☐

B $Na^+(aq) + Cl^-(aq) \rightarrow NaCl(s)$ ☐

C $2H^+(aq) + O^{2-}(aq) \rightarrow H2O(l)$ ☐

D $H2(g) + OH^-(aq) \rightarrow H2O(l)$ ☐

[1 mark]

0 6 . 2 Hydrochloric acid is a strong acid. Ethanoic acid is a weak acid. Explain the difference between a strong acid and a weak acid.

[2 marks]

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0 6 . 3 A solution of hydrochloric acid has a pH of 1. Water is added until the pH is 3. Describe how the concentration of hydrogen ions has changed.

[2 marks]

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0 6 . 4 Zinc oxide reacts with hydrochloric acid to form zinc chloride and water. Write a balanced symbol equation for this reaction.

[2 marks]

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0 6 . 5 Zinc sulfate is a soluble salt. Describe how a student could make a pure, dry sample of zinc sulfate crystals from zinc oxide powder and dilute sulfuric acid.

[6 marks]

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0 7 A student did a titration to find the concentration of a sodium hydroxide solution. The student used 25.0 cm^3 of sodium hydroxide solution in a conical flask and sulfuric acid of concentration 0.100 mol/dm^3 in a burette. The table shows the volumes of sulfuric acid needed to reach the end point.

Titration	**Rough**	**1**	**2**	**3**	**4**
Volume of sulfuric acid in cm^3	23.10	22.45	22.85	22.50	22.40

0 7 . 1 The student added phenolphthalein indicator to the sodium hydroxide solution. Give the colour change at the end point.

[1 mark]

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0 7 . 2 Concordant results are within 0.10 cm^3 of each other. Calculate the mean volume of sulfuric acid, using only the concordant results.

[2 marks]

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0 7 . 3 The equation for the reaction is: H2SO4 + 2NaOH → Na2SO4 + 2H2O. Calculate the concentration of the sodium hydroxide solution in mol/dm^3. Give your answer to 3 significant figures.

[4 marks]

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0 7 . 4 Calculate the concentration of the sodium hydroxide solution in g/dm^3. Relative formula mass (Mr) of NaOH = 40.

[1 mark]

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0 8 This question is about electrolysis. The table shows the products formed when some aqueous solutions are electrolysed using inert electrodes. Some products are missing (X, Y and Z).

Solution	Product at negative electrode	Product at positive electrode
potassium chloride	hydrogen	X
copper(II) sulfate	Y	oxygen
sodium nitrate	hydrogen	Z

0 8 . 1 Molten lead bromide, PbBr2, is electrolysed using inert electrodes. Write a half equation for the reaction at each electrode.

[2 marks]

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0 8 . 2 Give the products X, Y and Z.

[3 marks]

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0 8 . 3 Explain why hydrogen, and not potassium, is produced at the negative electrode when potassium chloride solution is electrolysed.

[2 marks]

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0 8 . 4 Oxygen is produced at the positive electrode when copper(II) sulfate solution is electrolysed. Write the half equation for this reaction.

[2 marks]

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0 8 . 5 Aluminium is extracted by electrolysis of a molten mixture of aluminium oxide and cryolite. Give the reason for using cryolite, and explain why the positive electrodes must be replaced regularly.

[2 marks]

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0 9 This question is about energy changes. A student investigated how the temperature of a mixture changes when sodium hydroxide solution is added to 25.0 cm^3 of dilute hydrochloric acid in a polystyrene cup. The student added the sodium hydroxide solution 5.0 cm^3 at a time and measured the highest temperature after each addition. The table shows the results.

Volume of sodium hydroxide added in cm^3	**0**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**
Temperature in °C	18.0	21.8	24.5	27.1	29.6	31.0	30.3	29.4	28.6

0 9 . 1 How do the results show that the reaction is exothermic?

[1 mark]

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0 9 . 2 The student concluded: 'Exactly 25 cm^3 of sodium hydroxide solution is needed to neutralise the acid.' Evaluate this conclusion.

[2 marks]

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0 9 . 3 Ammonia burns in oxygen: 4NH3 + 3O2 → 2N2 + 6H2O. Bond energies in kJ/mol: N–H 391, O=O 498, N≡N 945, O–H 464. Calculate the overall energy change for the reaction as written.

[4 marks]

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0 9 . 4 Hydrogen reacts with fluorine: H2 + F2 → 2HF. The overall energy change for this reaction is −542 kJ/mol. The bond energy of H–H is 436 kJ/mol and of F–F is 158 kJ/mol. Calculate the bond energy of H–F.

[3 marks]

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0 9 . 5 Which of these is the activation energy of a reaction? Choose one answer.

A The energy released when new bonds form. ☐

B The minimum energy that particles must have to react. ☐

C The difference between the energy of the products and the energy of the reactants. ☐

D The energy stored in the bonds of the reactants. ☐

[1 mark]

0 9 . 6 A simple chemical cell is made by placing two different metals in an electrolyte. A magnesium and copper cell gives 2.7 V. A zinc and copper cell gives 1.1 V. Both cells use the same electrolyte. Magnesium is more reactive than zinc. Predict the voltage of a cell made from magnesium and zinc in the same electrolyte. Explain your answer.

[2 marks]

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0 9 . 7 A hydrogen fuel cell uses an acidic electrolyte. Write a half equation for the reaction at each electrode.

[2 marks]

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END OF QUESTIONS