



# AQA Chemistry Paper 1

## Higher

## Separate Science

## Predicted Paper 2019

Name .....

Date .....

1 hour 45 minutes allowed

Similar to your real exam each question in this gets harder towards the end of each question, so if you find you can do the last part of a certain question, try the next question, they all start off easier then get harder.

Grade boundaries

These are VERY rough guesses! Getting an 8 or 9 on here does not guarantee you the same mark in the exam

- 9            75
- 8            65
- 7            55
- 6            45
- 5            35



## Exam Analysis

Question	Marks available	Marks gained	Topic	What do you need to do to improve ...
1	12		Practical	
2	22		Oxygen	
3	10		Neutralisation	
4	19		Quantitative chemistry	
5	22		Metals	
6	15		Titrations	
Total 100				



Question 1

a) Match the equipment to the function, draw **one** line from each description to the image of the equipment.

[4 marks]

For heating in an experiment
For accurately measuring volumes
For collecting and mixing solutions
Allows solutions to be poured with reduced spillage

A	
B	
C	
D	

b) The piece of equipment called 'C' can be used with a 'roaring blue' flame or an 'orange' flame. Describe the difference between these two flames and explain how the flames can be changed between the two types.

[4 marks]

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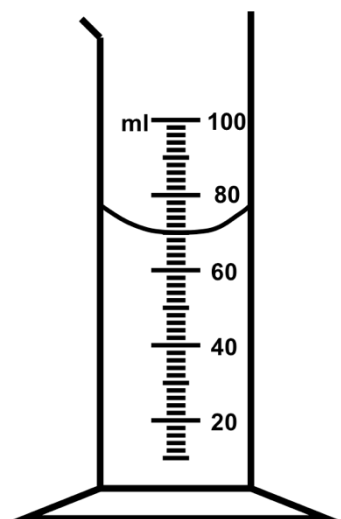
c) Give the name of the piece of equipment called A.

[1 mark]

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d) The equipment labelled B is a measuring cylinder, use the diagram and give the value of the liquid shown.

[1 mark]



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e) The equipment shown above can be used to separate a solid form of a soluble salt from the solution.

i. Zoie wanted to make a solid salt of magnesium chloride, suggest which acid she should add to magnesium carbonate to produce this salt.

[1 mark]

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ii. Which gas is released when magnesium carbonate is mixed with acid?

[1 mark]

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f) Zoie wanted to carry out this practical, here is the set of instructions she wrote to follow. Comment if her method would produce pure crystals of magnesium chloride, suggest two improvements that could be made.

[4 marks]

Method for making magnesium chloride salt

1. Put some acid in a conical flask
2. Add magnesium carbonate
3. Pour mixture through a funnel and collect the liquid at the bottom
4. Heat to evaporate the liquid away

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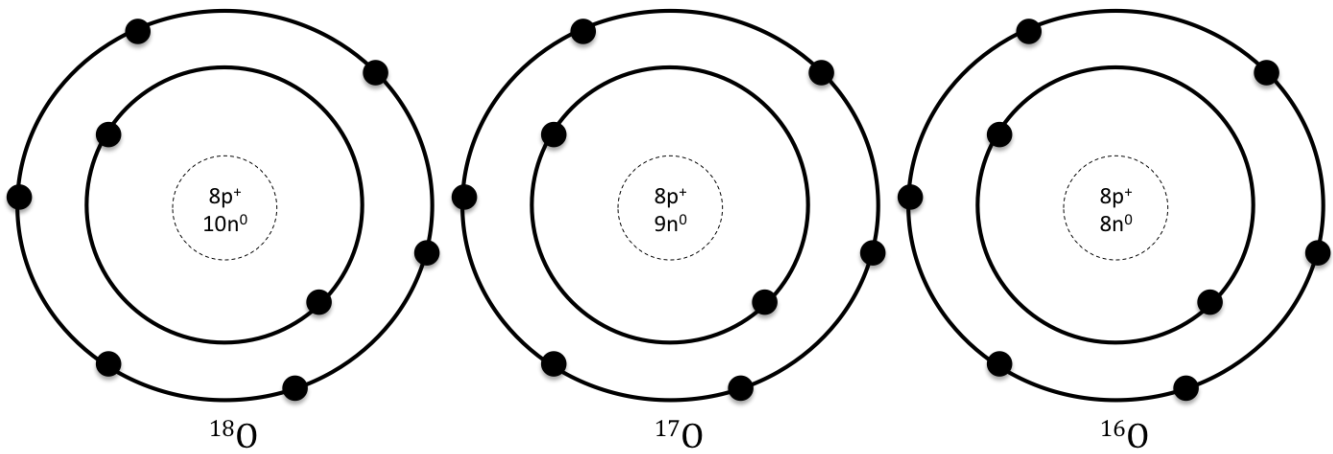
g) Name the type of bonding found in magnesium carbonate.

[1 mark]

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Question 2



a) The above image shows three different isotopes of oxygen, use the information in the diagrams and your scientific knowledge to compare these isotopes.

[3 marks]

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b) Oxygen can bond with two hydrogen atoms to form water.

i. Give the formula of water.

[1 mark]

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ii. Describe what happens when oxygen bond with hydrogen to form water. [4 marks]

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c) Explain the properties of water in terms of its structure. [4 marks]

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d) Sodium is a group one metal.

i. State how many electrons sodium will have on the outer ring. [1 mark]

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ii. State the properties you would expect to see from sodium metal. [2 marks]

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iii. A small lump of sodium metal is dropped into water, a few drops of universal indicator have been added to this water, what do you observe? [3 marks]

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iv. Write a balanced equation for the reaction between sodium metal and water. [4 marks]

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### Question 3

- a) Neutralisation is an example of an exothermic reaction, describe what is meant by the term exothermic reaction.

[1 mark]

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- b) Audrey and Harry decided to look at the temperature change that happens during neutralisation. They added small volumes of an alkali to an acid and measured the temperature each time. The acid was in a polystyrene cup that had a lid on it. A thermometer was inserted through the lid to allow them to measure the temperature as the experiment progressed.

- i. Describe the function that the lid performed.

[1 mark]

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- ii. Suggest an alternative piece of equipment that would allow more accurate readings of temperature.

[1 mark]

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- iii. Suggest a suitable piece of equipment to measure 5cm<sup>3</sup> volumes of alkali to be added to the acid.

[1 mark]

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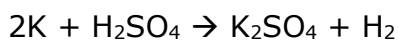
Question 4

- a) Sulfuric acid has the formula  $H_2SO_4$ , calculate the percentage by mass of sulfur in sulfuric acid.

[4 marks]

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- b) Potassium is added to sulfuric acid to make potassium sulfate, if 3.5g of potassium is used calculate how much potassium sulfate will be produced.



[4 marks]

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c) In part b 3.5g of potassium was used, calculate the number of moles of potassium this represented. Give your answer in standard form. [3 marks]

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d) Use the information above and your previous knowledge to give the formula of a sulfate ion. [1 mark]

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e) In the above reaction hydrogen gas is produced, describe how you test for the presence of hydrogen gas. [1 mark]

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f) The potassium sulfate made in this reaction is used in fertilisers, calculate the atom economy of this reaction. [3 marks]

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g) The hydrogen is released to the atmosphere as a waste product. Without making any changes to the reaction or experimental condition, suggest what can be done to improve the atom economy of this reaction.

[3 marks]

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Question 5

a) Unreactive metals are found in the ground are pure metals

i. Give an example of an unreactive metal the can be found as a pure metal [1 mark]

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ii. Describe the state in which more reactive metals are found in the ground [1 mark]

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b) Copper is one of the most valuable metals in our modern times, it is used in a large number of electrical comments, including wiring. Describe how electricity can flow through metals. [3 mark]

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c) When bonding with non-metals

i. What type of bond is formed? [1 mark]

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e) Indicate on the diagram below the location of the transition metals.

[1 mark]

1																	18	
1 H Hydrogen																	2 He Helium	
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon	
11 Na Sodium	12 Mg Magnesium											13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon	
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton	
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon	
55 Cs Caesium	56 Ba Barium	57 La Lanthanum	71 Lu Lutetium	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	103 Lr Lawrencium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium							
		57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium			
		89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium			

f) Give three common properties of transition metals.

[3 marks]

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g) Match the colour to the transition metal, draw **one** clear line for each metal ion.

[3 marks]

Iron (II)
Iron (III)
Copper (II)

Blue
Green
Red/brown



Question 6

a) A titration can be used to calculate the concentration of an acid or alkali. Indicators are used in titrations to show the end of point the reactions

i. What is meant by the term **end point** of the reaction.

[2 marks]

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ii. Phenolphthalein is used as an indicator, if the solution in the conical flask is an acid, describe what the student would see as the experiment progressed.

[4 marks]

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iii. Suggest an alternative to a colour changing indicator that could be used to find the end point of a titration.

[1 mark]

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b)  $29.5 \text{ cm}^3$  of calcium hydroxide is titrated against  $1.5 \text{ mol/dm}^3$  nitric acid. It was found that  $21.4 \text{ cm}^3$  of nitric acid was needed to reach the end point of the reaction. Calculate the concentration of the calcium hydroxide solution.

[8 marks]

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End of questions!  
😊  
You're doing a brilliant job!



## Answers

Question Number	Answer	Guidance
1a	A - For collecting and mixing solutions B - Allows solutions to be poured with reduced spillage C - For heating in an experiment D - For accurately measuring volumes	One mark for each point
1b	-blue flame is hotter -orange flame is less intense -blue flame has more oxygen OR complete combustion -changed by using the hole at the base of the Bunsen burner	One mark for each point
1c	Conical flask	
1d	70ml	
1ei	Hydrochloric acid	
1eii	Carbon dioxide	
1f	No, pure crystals would be made as separation is not complete  -specific volume of acid should be used. -mix of acid and magnesium carbonate should be heated -Filter paper needs to be added to the funnel to separate out the solid particles  <b>For 4 pages of questions on this practical see my Required Practicals Exam Practice Workbook</b>	One mark for answer and one mark for reason  Any two from list
1g	ionic	
2a	-same number of protons OR same atomic number -same number of electrons -different number of protons OR different mass	One mark for each point
2bi	H <sub>2</sub> O	
2bii	-covalent bond -hydrogen shares one electron with oxygen -oxygen pairs with two hydrogens -so, they all have a full outer shell	One mark for each point
2c	-simple covalent structure -low boiling/melting point -due to weak intermolecular bonds -doesn't need much energy to break them	One mark for each point
2di	1	
2dii	-soft -reacts violently -dull surface colour as metal has reacted with oxygen in the air	Any two from list



2diii	-fizz OR gas released -flames -water turned universal indicator from green to purple	One mark for each point																		
2div	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$	One mark for each compound																		
3a	Energy given out OR heat OR hot	Heat																		
3bi	To stop heat/energy escaping																			
3bii	Data logger																			
3biii	Pipette OR small measuring cylinder																			
	<table border="1"> <thead> <tr> <th>WHAT can hurt you</th> <th>HOW it can hurt you</th> <th>How you can PREVENT it hurting you</th> </tr> </thead> <tbody> <tr> <td>Acid</td> <td>Irritant or corrosive</td> <td>Wear goggles to prevent it getting in eyes  Wash hands after use</td> </tr> <tr> <td>Alkali</td> <td>Irritant or corrosive</td> <td>Wear goggles to prevent it getting in eyes  Wash hands after use</td> </tr> <tr> <td>Spilt liquid</td> <td>Slips and falls</td> <td>Clear up small spills immediately  Inform teacher of large spills</td> </tr> <tr> <td>glassware</td> <td>Broken glass can cut</td> <td>Work well away from the edge of the bench to reduce the risk of glass being knocked off the bench  Inform teacher of any breakages, do not attempt to clear away broken glass</td> </tr> <tr> <td>Heat</td> <td>Burns caused by exothermic reaction</td> <td>Use insulating material to perform experiment in  Run any burns under cold water immediately</td> </tr> </tbody> </table> <p style="text-align: center;"><b>For 6 pages of questions on this practical see my Required Practicals Exam Practice Workbook</b></p>	WHAT can hurt you	HOW it can hurt you	How you can PREVENT it hurting you	Acid	Irritant or corrosive	Wear goggles to prevent it getting in eyes  Wash hands after use	Alkali	Irritant or corrosive	Wear goggles to prevent it getting in eyes  Wash hands after use	Spilt liquid	Slips and falls	Clear up small spills immediately  Inform teacher of large spills	glassware	Broken glass can cut	Work well away from the edge of the bench to reduce the risk of glass being knocked off the bench  Inform teacher of any breakages, do not attempt to clear away broken glass	Heat	Burns caused by exothermic reaction	Use insulating material to perform experiment in  Run any burns under cold water immediately	<p>This answer must have linked statements, What → how → prevent</p> <p>Not every risk needs to be mentioned to gain 6 marks</p> <p>1-2 marks This answer will have some valid points but will lack structure and not be complete</p> <p>3-4 marks The majority of the points are valid and correct but the answer is lacking scientific clarity</p> <p>5-6 marks This is a fluid answer, all points mentioned are correct and relevant, and the SPG is almost flawless</p>
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4a	$M_r \text{ of } H_2SO_4 = (1 \times 2) + (32 \times 1) + (16 \times 4)$ $= 98$ $(32/98) \times 100$ $= 33\%$	One mark for each point
4b	$2K : K_2SO_4$ $78 : 174$ $3.5 : x$ $x = 7.8g$	One mark for each point  Alternative methods may be used
4c	$\text{Moles} = \text{mass}/m_r$ $= 3.5/39$ $= 9.0 \times 10^{-2}$	One mark for each point
4d	$SO_4^{2-}$	
4e	Squeaky pop with lit splint	
4f	$M_r \text{ useful product} / M_r \text{ reactants} \times 100$ $(174/176) \times 100$ $= 98.9\%$	One mark for each point
4g	<ul style="list-style-type: none"> <li>-find a use for the waste product</li> <li>-capture and sell the hydrogen gas</li> <li>-production of ammonia OR hydrogenation OR other suitable use</li> </ul>	One mark for each point
5ai	Gold Silver Platinum	One from list
5aii	As metal ores	
5b	<ul style="list-style-type: none"> <li>-Delocalised electron</li> <li>-Positive metal atoms</li> <li>-free flow of electrons</li> </ul>	One mark for each point
5ci	Ionic	
5cii	Positive	
5d	<p>All marks can be gained from a carefully annotated diagram</p> <ul style="list-style-type: none"> <li>-Pure metals have atoms all the same size</li> <li>-in a pure metal the atoms are arranged in rows</li> <li>-these rows can slide over each other</li> <li>-leading to pure metals being soft</li> <li>-soft metals are not very useful in everyday life</li> </ul> <ul style="list-style-type: none"> <li>-alloys are mixtures of metals and other elements</li> <li>-not all atoms within an alloy are the same size</li> <li>-thus they cannot form rows</li> <li>-thus they cannot slide</li> <li>-this makes them harder</li> <li>-and more useful in everyday life</li> </ul>	1-2 marks This answer has some valid points but will lack structure & is not complete 3-4 marks The majority of points are valid & correct but answer is lacking scientific clarity 5-6 marks This is a fluid answer, all



		points mentioned are correct and relevant, and the SPG is almost flawless							
5e	From Sc to Zn								
5f	<ul style="list-style-type: none"> <li>-react slowly</li> <li>-good catalysts</li> <li>-variable ion states</li> <li>-hard</li> <li>-shiny</li> <li>-good conductors of heat</li> <li>-good conductors of electricity</li> </ul>	Any three from list							
5g	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>Iron (II)</td> <td rowspan="3" style="text-align: center; vertical-align: middle;"> </td> <td>Blue</td> </tr> <tr> <td>Iron (III)</td> <td>Green</td> </tr> <tr> <td>Copper (II)</td> <td>Red/brown</td> </tr> </table>	Iron (II)		Blue	Iron (III)	Green	Copper (II)	Red/brown	
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Iron (III)		Green							
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6ai	<ul style="list-style-type: none"> <li>-When neutralisation has occurred</li> <li>-equal number of H<sup>+</sup> and OH<sup>-</sup> ions</li> </ul>	One mark for each point							
6aii	<ul style="list-style-type: none"> <li>-colourless in acid solutions</li> <li>-pink colour in alkali solutions</li> <li>-after addition of alkali, pink starts to appear but goes away upon mixing</li> <li>-end point is the first permanent colour change</li> </ul>	One mark for each point  Use of the word CLEAR does not gain any marks							
6aiii	pH probe OR data logger								
6b	$\text{Ca(OH)}_2 + 2\text{HNO}_3 \rightarrow \text{Ca(NO}_3)_2 + 2\text{H}_2\text{O}$ Number of moles = concentration x volume OR $n = cv$ One mark for conversion to dm <sup>3</sup> $\text{Moles}_{\text{acid}} = 1.5 \times (21.4/1000) = 0.0321\text{mol}$ $2:1 \text{ ratio} = 0.0321\text{mol}/2 = 0.01605\text{mol}$ $0.01605\text{mol} = \text{con}_{\text{base}} \times (29.5/1000)$ $\text{con}_{\text{base}} = 0.54\text{mol/dm}^3$  for more grade 8 and 9 level maths in science see my workbook <b>Maths (The Chemistry Bits) for Science Students</b>	One mark for each point							