

# IGCSE Chemistry

## Dr Green's pre-exam checklist

### Section 1: Principles of Chemistry

Topic	I have made revision notes?	I have made revision cards?	I have done questions on checklist?
a) States of matter			
b) Atoms			
c) Atomic structure			
d) Relative formula masses and molar volumes of gases			
e) Chemical formulae and chemical equations			
f) Ionic compounds			
g) Covalent substances			
h) Metallic crystals			

### Section 2: Chemistry of the elements

Topic	I have made revision notes?	I have made revision cards?	I have done questions on checklist?
a) The Periodic Table			
b) Group 1 elements – lithium, sodium and potassium			
c) Group 7 elements – chlorine, bromine and iodine			
d) Oxygen and oxides			
e) Hydrogen and water			
f) Reactivity series			
g) Tests for ions and gases			

### Section 3: Organic Chemistry

Topic	I have made revision notes?	I have made revision cards?	I have done questions on checklist?
a) Introduction			
b) Alkanes			
c) Alkenes			
d) Ethanol			

### Section 4: Physical Chemistry

Topic	I have made revision notes?	I have made revision cards?	I have done questions on checklist?
a) Acids, alkalis and salts			
b) Energetics (heating changes)			
c) Rates of reaction			
d) Equilibria (reversible)			

### Section 5: Chemistry in Industry

Topic	I have made revision notes?	I have made revision cards?	I have done questions on checklist?
a) Extraction and uses of metals			
b) Crude oil			
c) Synthetic polymers			
d) The industrial manufacture of chemicals			

## Section 1: Principles of Chemistry

### States of Matter:

1. Draw the arrangement of particles in a solid, liquids and gas
2. What is the difference between evaporation and sublimation?
3. Describe the motion of particles in a gas

### Atoms:

1. Describe what would happen to a beaker of water if a crystal of potassium manganate was placed into it and left to dissolve?
2. Define the term diffusion
3. Define the term molecule. How many atoms are in a molecule of methane?
4. Why is H<sub>2</sub>O a compound and not an element?
5. How would you separate a mixture of liquids with similar boiling points?
6. How can a chromatogram be used to identify what is present in a mixture?

### Atomic structure:

1. Where are protons and neutrons found in an atom?
2. Which subatomic particle has the smallest mass? Where is it found in an atom and what is its symbol?
3. What atom has a mass number of 12 and an atomic number of 6?
4. 75 % of Cl atoms are Cl<sup>35</sup> and 25 % of Cl atoms are Cl<sup>37</sup>. Calculate the relative atomic mass of Cl
5. Elements in the Periodic table are arranged in order of what?
6. State the electronic configuration of oxygen
7. How many valence electrons does argon have?

### Relative formula masses

8. What is the relative formula mass (*M<sub>r</sub>*) of CuSO<sub>4</sub>
9. If you have 1 mole of Cu atoms how many would you have?
- 10. What is the name of this number in Q9?**
11. If you burn 12 grams of Mg in air what mass of MgO would you predict to make?
- 12. If you have 48 dm<sup>3</sup> of nitrogen now many moles of gas do you have?**

### Chemical formulae and equations:

1. Write the chemical equation for the reaction of magnesium with oxygen
2. Rewrite this equation using state symbols and balance it: CaCO<sub>3</sub> + HCl → CaCl<sub>2</sub> + CO<sub>2</sub> + H<sub>2</sub>O
3. CuSO<sub>4</sub>·5H<sub>2</sub>O. What mass of water would you expect to be present if you had 160 grams of CuSO<sub>4</sub>
4. What is the empirical formula of C<sub>3</sub>H<sub>10</sub>O<sub>5</sub>?
5. If you burn 12 grams of C in excess air what mass of CO<sub>2</sub> would you make? What volume would this occupy?
- 6. State the equation to calculate % yield? If you produced 22g of CO<sub>2</sub> above work out the percentage yield**
7. How many moles are there in 25 cm<sup>3</sup> of 0.1 mol/dm<sup>3</sup> HCl?

### Ionic compounds:

1. What is the electronic configuration of a Na<sup>+</sup> ion?
2. 2 O<sup>2-</sup> → O<sub>2</sub> + 4e<sup>-</sup>. Does this equation show oxidation or reduction? Explain your answer.
3. What is the charge and formula of the nitrate ion?
4. What charge will the following atom form if it has the electronic configuration of 2.8.3?
5. An ionic bond is described as a strong electrostatic attraction between what?
6. Why do ionic compounds have high melting points?
- 7. Why does magnesium chloride have a higher melting point than sodium chloride?**
- 8. What type of structure does an ionic crystal form?**
- 9. Draw a diagram to represent the positions of the ions in a crystal of sodium chloride**

### Covalent substances

1. How many electrons are shared in a covalent bond?
2. What is the attraction between in a covalent bond?
3. Draw a dot and cross diagram for ammonia
4. A new element found on Mars has a simple molecular structure. Would you expect it to have a high or low m.p.?
5. Why do simple molecules have low melting points?
6. Why does diamond have a high melting point? What bonds are broken?
- 7. Draw a diagram to show how atoms are arranged in graphite**
- 8. State a use of diamond and a use of graphite**

### Metallic crystals:

1. What two particles are present in a metal lattice?
2. Explain why (i) metals are able to conduct electricity and (ii) they are malleable

### Electrolysis:

1. Current can be described as the flow of ions or ?
2. Why does diamond not conduct electricity?
3. What two ways can you make solid NaCl conduct electricity?
4. What is an electrolyte?
5. What two products are formed during electrolysis of molten lead bromide?
6. Why are inert electrodes used in electrolysis? What are they made from?
- 7. What are the products of electrolysis of CuSO<sub>4</sub>(aq)?**
8. What is the positive electrode called in electrolysis? Write a half equation for a reaction that may occur at this electrode.
- 9. How many moles of e<sup>-</sup> does one Faraday represent?**

## Section 2: Chemistry of the elements

The Periodic Table:

1. What element is in group 4 and period 3 of the Periodic table?
2. Where in the Periodic table are metals located?
3. If an element forms an acid oxide is it a metal or a non-metal?
4. Why do all elements in group 1 have similar chemical properties?
5. Why are elements in Group 0 described as inert?

Group 1 elements:

1. Write the chemical equation for the reaction of sodium with water
2. Describe the trend in reactivity as you go down Group 1?
3. **Explain the trend in reactivity as you go down Group 1**

Group 7 elements:

1. List the colours and physical states of each halogen at room temperature?
2. What colour do you predict astatine to have?
3. How is HCl(aq) formed from HCl(g)?
4. Why is HCl acidic in water but not in methylbenzene?
5. Which is the most reactive halogen?
6. What would you observe in this reaction:  $2\text{KI} + \text{Br}_2 \rightarrow 2\text{KBr} + \text{I}_2$
7. Why is the reaction above described as a redox reaction?

Oxygen and oxides

1. State the % abundance of each gas in the atmosphere
2. If copper reacted with oxygen in the air what substance is formed?
3. Write the chemical equation for the production of oxygen from  $\text{H}_2\text{O}_2$ . State the catalyst.
4. Write the chemical equation for the reaction of Mg with oxygen in air. What pH will the oxide form?
5. Write the chemical equation for the reaction of  $\text{CaCO}_3$  with HCl to make  $\text{CO}_2$
6. Write the chemical equation for the thermal decomposition of  $\text{CuCO}_3$
7. State two properties of  $\text{CO}_2$
8. Explain why  $\text{CO}_2$  is used in (i) fire extinguishers and (ii) fizzy drinks
9. State the name of one green house gas and describe its effect on global temperatures

Hydrogen and water

1. Write chemical equations for the following metals with HCl and  $\text{H}_2\text{SO}_4$ 
  - a. magnesium, aluminum, zinc and iron
2. Write an equation for the combustion of hydrogen
3. Describe how anhydrous copper sulphate can be used to test for the presence of water
4. What is the boiling point of pure water?

Reactivity series:

1. Put the following metals in order of their reactivity with dilute acid: sodium, silver, lithium, calcium, magnesium, potassium, aluminium, zinc, iron, copper, and gold
2. Write the chemical equation for the reaction of Ca with sulphuric acid
3.  $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$  Is Na being oxidised or reduced in this reaction? Explain your answer.
4. Define the term (i) oxidising agent and (ii) reducing agent
5. State three conditions needed for iron to rust
6. State three ways in which rusting can be prevented
7. Explain how the sacrificial protection of iron works using zinc

Tests for ions and gases

1. State the flame colours of the following ions:  $\text{Li}^+$ ,  $\text{Na}^+$ ,  $\text{K}^+$  and  $\text{Ca}^{2+}$  using flame tests
2. What is the test for the ammonium ion?
3. What colours do the following ions form with NaOH:  $\text{Cu}^{2+}$ ,  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$
4. State the colours of the precipitates of the halides with dilute  $\text{HNO}_3$  and  $\text{AgNO}_3$
5. Describe the test for the sulphate ion
6. Describe the test for the carbonate ion
7. Describe the tests for the following gases: hydrogen, oxygen, carbon dioxide, ammonia and chlorine

## Section 3: Organic Chemistry

### Introduction:

1. Define the following terms: homologous series, hydrocarbon, saturated, unsaturated, and isomer

### Alkanes:

1. State the general formula of alkanes
2. Draw the displayed formulae of the first 5 alkanes
3. Write a chemical equation for the complete combustion of methane
4. Draw the displayed formula of the product formed when bromine reacts with methane with UV light
5. Draw all the isomers of butane

### Alkenes:

1. What is the molecular formula of an alkene with 60 C atoms?
2. Draw displayed formulas of the first 5 alkenes
3. Describe the test for an alkene using bromine water
4. Draw all the isomers of butene

### Ethanol:

1. **State the conditions for the production of ethanol from steam and ethane**
2. **Write the chemical equation for the manufacture of ethanol from glucose**
3. **State two reasons why fermentation is the preferred method of producing ethanol in Brazil**
4. **Write the chemical equation for the dehydration of ethanol and state the catalyst used**

## Section 4: Physical Chemistry

### Acids, Alkalis and Salts:

1. State the colours of the following indicators in acid AND alkali: litmus, phenolphthalein and methyl orange
2. What pH are the following: pure water, sodium hydroxide solution, vinegar solution?
3. Why is universal indicator not a good indicator to use in a titration?
4. Are acids proton donors or proton acceptors?
5. Write the chemical equation for the reaction of nitric acid with calcium oxide
6. Learn the following:
  - i all common sodium, potassium and ammonium salts are soluble
  - ii all nitrates are soluble
  - iii common chlorides are soluble, except silver chloride
  - iv common sulfates are soluble, except those of barium and calcium
  - v common carbonates are insoluble, except those of sodium, potassium and ammonium
7. Describe the method of how to prepare a soluble salt of NaCl from NaOH and HCl
8. Describe the method of how to prepare an insoluble salt of  $\text{Cu}(\text{OH})_2$  from copper (II) sulphate and sodium hydroxide
9. Draw and label the equipment you would need to perform an acid/alkali titration

### Energetics (heat changes):

1. What name is given to a reaction in which heat energy is given out?
2. When  $25 \text{ cm}^3$  of acid is reacted with  $25 \text{ cm}^3$  of alkali the temperature change was  $4^\circ\text{C}$ . Calculate the heat released in this reaction using  $Q=mCAT$ .
3. **If 0.25 moles of acid were used in Q2. Work out the molar enthalpy change in kJ/mol**
4. What sign is  $\Delta H$  for an endothermic reaction?
5. Draw a simple energy level diagram for the combustion of methane. Label the reactants, products and  $\Delta H$ .
6. Making bonds is exothermic. What is breaking bonds?
7. **Use average bond enthalpies in your revision guide to work out the enthalpy change when hydrogen reacts with chlorine**

### Rates of reaction:

1. Describe an experiment to investigate how temperature affects the rate of reaction between  $\text{CaCO}_3$  and HCl. List the equipment you will need, state the independent variable, the dependent variable and the control variables
2. **Describe** the effect of using a catalyst of the rate of reaction
3. Draw an energy profile for a reaction and label the activation energy
4. **Explain** the effect of increasing the pressure of a gas on the rate of reaction in terms of particle collision theory
5. Define the term activation energy and describe how a catalyst speeds up the rate of a reaction

### Equilibria (reversible reactions):

1. What is the symbol used to show that a reaction is reversible?
2. Describe how the thermal decomposition of ammonium chloride is reversible
3. What two conditions are true at dynamic equilibrium?
4. If you increase the temperature on an exothermic reaction what will happen to the position of equilibrium?

## Section 5: Chemistry in Industry

Extraction and uses of metals:

1. Metals are rarely found as elements in the Earth's crust. What form are most metals found?
2. What is the name of the ore in which aluminium is found?
3. What is the function of cryolite in the extraction of aluminium from aluminium oxide?
4. Why do the positive electrodes need to be replaced in the extraction of aluminium?
5. Why is the extraction of aluminium an expensive process?
6. Write ionic half-equations for the reactions at the electrodes in the extraction of aluminium
7. What are the roles of haematite, coke, limestone and air in the blast furnace?
8. State two uses of iron and aluminium. For each use, explain why the metal is a good choice

Crude oil:

1. Crude oil is a mixture of hydrocarbons. Define the term hydrocarbon
2. What process separates crude oil into different fractions?
3. State the main use of the following fractions: refinery gases, gasoline, kerosene, diesel, fuel oil and bitumen
4. Which fraction above is (i) the most viscous and (ii) has the highest boiling point?
5. What is the poisonous gas that is formed by the incomplete combustion of fuels?
6. What is formed in car engines when nitrogen gas reacts with oxygen?
7. What problem is caused by sulphur dioxide and state one of its effects
8. What is cracking and why is cracking necessary?
9. State the conditions needed for catalytic cracking and write a chemical equation for the cracking of pentane

Synthetic polymers:

1. What joins together to make an addition polymer?
2. Draw the repeating units of addition polymers of poly(ethene), poly(propene) and poly(chloroethene)
3. Draw the monomer of poly(ethene)
4. State the uses of poly(ethene), poly(propene) and poly(chloroethene)
5. State two disadvantages of addition polymers
6. **What type of polymer is nylon?**
7. **What molecule, apart from the polymer, is normally formed during condensation polymerisation?**

The industrial manufacture of chemicals:

1. What are the two raw materials needed for the Haber process
2. State the three conditions of the Haber process
3. Why is the reaction mixture cooled in the Haber process?
4. State two uses of  $\text{NH}_3$
5. **State the raw materials needed to make sulphuric acid**
6. **State the three conditions of the contact process**
7. **State three uses of sulphuric acid**
8. **Draw a diaphragm cell and explain how it can be used to make NaOH and  $\text{Cl}_2$**
9. **Write ionic half-equations for the reactions at the electrodes in the diaphragm cell**
10. **State two uses of NaOH and  $\text{Cl}_2$**