GCSE REVISION 1

Atoms, ions, equations, Periodic Table

1 a) Complete the following table about protons, neutrons and electrons.

	neutron	proton	electron
relative charge			
relative mass			

b) Define the term **mass number**. .....

..... c) Define the term **atomic number**. .....

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2 Complete the following table about some atoms and ions. The first row has been done for you.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron structure
F^{-}	ion	9	19	9	10	10	2,8
Ar							
Al^{3+}							
				16	18	18	
				19	20	18	
				15	16	15	

3 The element indium consists of two isotopes. 4.3% of the atoms are $^{113}In^{3+}$ and 95.7% of the atoms are $^{115}In^{3+}$. a) What makes both of these atoms of the element indium? .....

..... b) What are isotopes? .....

..... c)

Calculate the relative atomic mass of indium. Give your answer to 4 significant figures.

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4 The diameter of an indium atom is 310 pm.

a) What is the diameter of an indium atom in metres? Give your answer in standard form.

..... b) How many indium atoms would fit in a line 20 cm long? Give your answer to 3 significant figures.

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5 This question is about the Periodic Table

a) Name each of the following groups.

Group 1 .....

Group 7 .....

Group 0 .....

b) Which group would the following elements be in?

element with electron structure 2,8,6 .....

element with electron structure 2,8,8 .....

element with electron structure 2,8,18,3 .....

6 Balance each of the following equations.

a) $K + O_2 \rightarrow K_2O$

b) $CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_2$

c) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can find PNE numbers in ions			Can use standard form		
Good SPG			Knows what determines an element			Can convert units		
Knows mass and charge of PNE			Knows what isotopes are			Can name common PT groups		
Can define atomic & mass numbers			Find A_r from isotope data			Determine group from electron structure		
Can find PNE numbers in atoms			Can use sig figs			Balance equations		

GCSE REVISION 4

Atoms, ions, equations, Periodic Table, mixtures

1 Complete the following table about some atoms and ions.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron structure
$^{39}K^{+}$							
				13	14	10	
				8	8	10	

2 a) The element potassium consists of two isotopes. 93.3% of the atoms are $^{39}K^{+}$ and the rest of the atoms are $^{41}K^{+}$. Calculate the relative atomic mass of potassium. Give your answer to 3 significant figures.

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b) The diameter of a potassium atom is 440 pm. State this in metres in standard form.

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3 a) i) Describe what you see when sodium burns in oxygen. .....

..... ii)

Write a balanced equation for this reaction.

..... iii)

Sodium oxide is formed in this reaction. Explain why this sodium oxide has a high melting point.

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b) Potassium is more reactive then sodium. Explain why. .....

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4 Iron is a transition metal. Give three ways in which transition metals are different to the Group 1 (alkali metals).

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5 a) Chlorine is a gas at room temperature made of molecules. The boiling point of chlorine is –34°C. i) Give the formula of chlorine molecules. ..... ii) Explain why chlorine has a low boiling point. .....

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..... b) Which is more reactive, chlorine or bromine. Explain your answer.

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c) Complete the following equations. Write *no reaction* if there is no reaction.

i) chlorine + sodium fluoride ..... ii) bromine + potassium iodide .....

6 Dimitri Mendeleev is known as the "father of the Periodic Table". What did Mendeleev do in terms of the Periodic Table and why were his ideas accepted?

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7 What method would you use to separate each of the following mixtures?

a) water from a solution of salt in water ..... b) octane from a mixture of pentane and octane (they are miscible liquids) ..... c) sodium nitrate from a solution of sodium nitrate in water ..... d) petrol from a mixture of petrol and water (they are immiscible liquids) ..... e) calcium carbonate from a mixture with water ($CaCO_3$ is insoluble in water) .....

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can use standard form			Understand term diatomic		

Good SPG			Can convert units			Why molecular substances have low mpt		
Can find PNE numbers in atoms			What happens when Na reacts with O_2			Know & explain Group 7 reactivity trend		
Can find PNE numbers in ions			Write equation when Na reacts with O_2			What happens in halogen displacements		
Find A_r from isotope data			Why ionic substances have high mpt			Why Mendeleev's ideas were accepted		
Can use sig figs			Know & explain Group 1 reactivity trend			Can give methods to separate mixtures		

GCSE REVISION 6

Formulae, equations, particles, structure & bonding

1 Write the formula of the following ionic compounds.

a) sodium sulfate ..... c) ammonium bromide ..... b) iron(III) oxide ..... d) aluminium nitrate .....

2 Write balanced equations for the following equations.

a) $Na + O_2 \rightarrow Na_2O$ ..... b)

magnesium + nitric acid → magnesium nitrate + hydrogen

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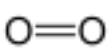
3 Complete the following table about some atoms and ions. The first row has been done for you.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron structure
F^{-}	ion	9	19	9	10	10	2,8
Al^{3+}							
	atom			19	20		
				16	18	18	

4 What is the structure type of each of the following substances. Tick the correct box.

name	aluminium oxide	potassium	sulfur dioxide	graphite	buckminster - fullerene	helium	calcium bromide	sucrose
formula	Al_2O_3	K	SO_2	C	C_{60}	He	$CaBr_2$	$C_{12}H_{22}O_{11}$
giant covalent								
ionic								
metallic								
molecular								
monatomic								

5 Oxygen is a molecular substance containing O_2 molecules. Explain why oxygen has a very low boiling point (–183°C).



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6 Diamond and graphite are both forms of carbon. They both have very high melting points but only graphite conducts electricity. Explain these properties by discussing the structure and bonding in each substance.

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7 Carbon dioxide (CO_2) and silicon dioxide (SiO_2) are both oxides of Group 4 elements. Carbon dioxide has a very low boiling point (–78°C) while silicon dioxide has a very high melting point (1600°C). Explain this difference by discussing structure and bonding in each substance.

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8 Aluminium metal is extracted from aluminium oxide by electrolysis. The aluminium oxide must be molten to conduct and melts at 2072°C. Explain, by discussing structure and bonding, why aluminium oxide must be molten to conduct and why it has a high melting point.

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Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can find PNE numbers in atoms			Why giant covalent have high mpt		
Good SPG			Can find PNE numbers in ions			Why giant covalent conduct or not		
Write formulae			Identify structure type from formula			Why ionic have high mpt		
Write balanced equations			Why molecular substance has low mpt			Why ionic conduct or not		

1 Give the formula of the following ionic substances.

GCSE REVISION 7

Calculations

a) potassium oxide ..... d) magnesium hydroxide ..... b) aluminium bromide ..... e) ammonium iodide ..... c) iron(III) sulfide ..... f) calcium nitrate .....

2 Calculate the relative formula mass of the following substances.

a) chlorine, Cl_2 ..... b) ammonium sulfate, $(NH_4)_2SO_4$ .....

3 a) What mass of sodium reacts with 95 g of titanium chloride? $TiCl_4 + 4Na \rightarrow Ti + 4NaCl$

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b) Calculate the percentage atom economy to make titanium in this reaction.

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4 Ammonia is made by reaction of nitrogen with hydrogen. $N_2 + 3H_2 \rightarrow 2NH_3$

a) Calculate the maximum mass of ammonia that could be formed from reaction of 12 g of hydrogen reacting with nitrogen.

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b) In this reaction, only 15 g of ammonia was formed. Calculate the percentage yield.

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..... c)

Suggest two reasons why the yield was less than 100%.

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5 In an experiment, 4.0 g of calcium was reacted with 4.0 g of chlorine. One of the chemicals was in excess. Determine which is the limiting reagent and then calculate the mass of calcium chloride formed.

$$Ca + Cl_2 \rightarrow CaCl_2$$

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6 25.0 cm^3 of a solution of calcium hydroxide was titrated against a solution of 0.100 mol/dm^3 hydrochloric acid. 26.3 cm^3 of the hydrochloric acid was needed to neutralise the calcium hydroxide.

a) Describe how the titration is done.

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b) Calculate the concentration of the calcium hydroxide in mol/dm^3. The equation for the reaction is shown. $2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$

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Calculate the concentration of the calcium hydroxide in g/dm^3.

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Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can work out mass from moles			Work out moles for solutions		
Shows suitable working			Can work out % atom economy			Convert mol/dm^3 to g/dm^3		
Can write ionic formulae			Can work out % yield			Does not round too much		
Can work out M_r			Understands why yield < 100%			Can use sig figs		
Work out moles from mass			Understands limiting reagents			Gives units		
Use equation to find reacting moles			Can describe how to do a titration					

GCSE REVISION 8

Atomic structure, structure & bonding, formulae & equations

1 Complete the following table about some atoms and ions.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron structure
$^{27}_{13}Al^{3+}$							
^{14}C							
$^{31}_{15}P^{3-}$							
				8	10	10	

2 The element indium consists of two isotopes, with 4.3% of the atoms are ^{113}In and 95.7% of the atoms are ^{115}In.

a) What are isotopes? .....

..... b)

Calculate the relative atomic mass of indium. Give your answer to 4 significant figures.

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3 Give the formula and structure type of each of the following substances. Tick the correct box.

name	lithium oxide	argon	ammonia	silver(I) nitrate	buckminster fullerene	diamond
formula						
giant covalent						
ionic						
metallic						
molecular						
monatomic						

4 Balance these equations

a) $Mg + HNO_3 \rightarrow Mg(NO_3)_2 + H_2$

b) $C_4H_8 + O_2 \rightarrow CO_2 + H_2O$

c) $Fe + Cl_2 \rightarrow FeCl_3$

5 Give the formula of the following ionic substances.

a) iron(III) oxide ..... c) aluminium nitrate ..... b) potassium sulfate

..... d) barium hydroxide .....

6 Sodium chloride has a high melting point (801˚C) while water has a low melting point (0˚C). Explain this difference.

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7 Aluminium conducts electricity as a solid and when molten. Aluminium oxide does not conduct electricity as a solid but does when molten. Explain this difference.

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8 Nickel reacts with copper(II) sulfate to form copper: $Ni + CuSO_4 \rightarrow NiSO_4 + Cu$ a) Write two half equations for this reaction.

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..... b) Write an ionic equation for this reaction.

..... c) Explain clearly why this is a redox reaction. .....

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d) Nickel displaces copper in this reaction because it is more reactive than copper. Explain, in terms of electrons, why nickel is more reactive than copper.

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Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can find A_r from isotope abundance			Why substances conduct or not		
Good SPG			Write formulae			Write half equations for displacement		
Can find PNE numbers in atoms			Identify structure type from name			Write ionic equation for displacement		
Can find PNE numbers in ions			Write balanced equations			Explain displacement in terms of redox		
Knows what isotopes are			Why substances have high/low mpts					

1 Give the formula of the following ionic substances.

GCSE REVISION 9

Calculations 2

a) aluminium chloride ..... d) calcium nitrate ..... b) potassium sulfide ..... e) magnesium hydroxide ..... c) sodium sulfate ..... f) iron(II) oxide .....

2 Calculate the relative formula mass of the following substances.

a) fluorine, F_2 ..... b)

iron(III) nitrate, $Fe(NO_3)_3$ .....

3 Calcium oxide is made from the thermal decomposition of calcium carbonate: $CaCO_3 \rightarrow CaO + CO_2$

a) Calculate the maximum mass of calcium oxide that could be formed from heating 500 g of calcium carbonate.

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b) In a reaction, 250 g of calcium oxide was formed from heating 500 g of calcium carbonate. Calculate the percentage yield for this reaction.

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c) Suggest two reasons why the yield was less than 100%.

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d) Calculate the atom economy to make calcium oxide from calcium carbonate by this reaction.

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4 What mass of oxygen reacts with 270 g of aluminium? $4Al + 3O_2 \rightarrow 2Al_2O_3$

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5 Calculate the volume of the following gases at room temperature and pressure.

a) 3 moles of oxygen, O_2 .....

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b) 22 g of carbon dioxide, CO_2 .....

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6 What volume of hydrogen gas is needed to react with 10 dm^3 of nitrogen to make ammonia, with the volume of all gases measured at the same temperature and pressure?

$$N_2 + 3H_2 \rightarrow 2NH_3$$

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7 5.6 g of iron (Fe) reacts with 24 g of bromine (Br_2) to make a compound containing iron and bromine only. Calculate the moles of iron and bromine and use this to determine the balanced equation for the reaction.

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8 25.0 cm^3 of a solution of citric acid, which is represented by H_3T in the equation, reacted with 26.4 cm^3 of 0.100 mol dm^{-3} sodium hydroxide solution in a titration.

$$H_3T + 3NaOH \rightarrow Na_3T + 3H_2O$$

a) Calculate the concentration of the citric acid in mol/dm^3. Give your answer to 3 significant figures.

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c) Calculate the concentration of the citric acid in g/dm^3. The relative formula mass of citric acid is 226. Give your answer to 3 significant figures.

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Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can work out mass from moles			Deduce molar reacting ratio from mass		
Shows suitable working			Can work out % atom economy			Work out moles for solutions		
Can write ionic formulae			Can work out % yield			Convert mol/dm^3 to g/dm^3		
Can work out M_r			Understands why yield < 100%			Does not round too much		
Work out moles from mass			Work out gas volume from mass or mol			Can use sig figs		
Use equation to find reacting moles			Understands reacting gas volumes			Gives units		

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GCSE REVISION 10

Chemical Reactions 1

1 Complete **word** equations for each of the following reactions. Write ***no reaction*** if no reaction takes place. a) copper + oxygen → ..... b) hydrogen sulfide + oxygen → ..... c) potassium + water → ..... d) calcium carbonate + hydrochloric

acid → ..... e) nickel oxide + nitric acid →

..... f) magnesium + sulfuric acid →

..... g) ammonia + hydrochloric acid →

..... h) calcium hydroxide + nitric acid →

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2 Classify each of the following metals as having high / medium / low reactivity.

a) silver ..... c) iron ..... c) lithium ..... b) magnesium ..... d) zinc ..... e) copper .....

3 Complete the table about the following reactions by ticking the correct boxes.

equation	transfer of		type of reaction	
	protons	electrons	redox	acid-base
$Ca + 2HCl \rightarrow CaCl_2 + H_2$				
$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$				
$MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$				
$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$				

4 a) Complete the table to show the products of the electrolysis of the following compounds.

compound	state	product at positive electrode	product at negative electrode
potassium bromide	molten		
copper sulfate	aqueous		
sodium iodide	aqueous		

b) Write balanced half equations for the following electrolysis conversions.

i) $Cu^{2+} \rightarrow Cu$ ..... iii) $O^{2-} \rightarrow O_2$ ..... ii) $Cl^- \rightarrow Cl_2$ ..... iv) $H^+ \rightarrow H_2$ .....

5 When an iron nail is placed in copper(II) sulfate solution, a displacement reaction takes place forming copper metal and iron(II) sulfate.

a) Explain why iron displaces copper in this reaction. .....

..... b) Write a balanced equation for this reaction.

..... c)

Write the simplest ionic equation for this reaction.

..... d)

Write two half equations to show what happens in this reaction.

..... e) Explain clearly why this is a redox reaction. .....

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6 When a aqueous solution of bromine (Br_2) is added dropwise to an aqueous solution of potassium iodide (KI), a displacement reaction takes place to form brown iodine (I_2) and potassium bromide (KBr) in the solution.

a) Explain, **in detail**, why bromine displaces iodine in this reaction. .....

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..... b) Write a balanced equation for this reaction.

..... c)

Write the simplest ionic equation for this reaction. ..... d) Write two half equations to show what happens in this reaction.

..... e) Explain clearly why this is a redox reaction. .....

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Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Approx. reactivity of common metals			Write ionic equations for displacement		
Good SPG			Deduce if proton or electron transfer			Write half equations for displacement		
Write word equations for metal reactions			Write half equations			Explain displacement in terms of redox		
Write word equations for acid reactions			Understands why displacement occurs			Can explain halogen reactivity trend		

GCSE REVISION 11

Atomic structure, structure & bonding

1 Give the formula of each of the following ions.

ion	sodium	oxide	magnesium	nitrate	carbonate
formula					

ion	hydroxide	bromide	sulfide	aluminium	ammonium
formula					

2 What is the structure type of each of the following substances? Tick the correct box. Also give the correct formula

name	sodium sulfate	potassium	carbon dioxide	iodine	helium	diamond	buckminster - fullerene	aluminium oxide
formula								
giant covalent								
ionic								
metallic								
molecular								
monatomic								

3 Complete the following table about some atoms and ions. The first row has been done for you.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron structure
$^{27}_{13}Al$							
S^{2-}							

				17	20	17	
				12	12	10	

4 Water is a molecular substance containing H_2O molecules. Explain why water has a low boiling point 100°C).

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5 Calcium oxide has a very high melting point (2572°C), does not conduct electricity as solid but does when molten. Explain these properties.

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6 Steel is an alloy of iron. Steel is harder than pure iron, which is soft. Explain what an alloy is, why pure iron is soft and why steel is harder.

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7 a How much greater is the surface area to volume ratio of a cube with 2 cm sides compared to one with 10 cm sides? Show full working.

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..... b Explain why nanoparticles of gold have different properties to bulk gold.

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Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can find PNE numbers in ions			Know what an alloy is		
Good SPG			Can find PNE numbers in atoms			Why alloys are softer than pure metals		
Knows formula and charge of ions			Why molecular substance has low mpt			Calculate surface area : volume ratio		
Identify structure type from formula			Why ionicr substance has high mpt			Explain different nanoparticle properties		
Write formulae			Explain conductivity of substances					