C3 (Higher) Key Questions that will help you get the level you deserve
Learn these! Try each one. Ones you don't know try again and again
Fold over 'The Answers' column and reveal having attempted the questions

Basic Principles			
	Understand that in a chemical reaction, reactants are changed into products		
	Recognise the reactants and products in a word equation		
	Construct word equations given the reactants and products		
	Recognise the reactants and the products in a symbol equation		
1.	What are the number of elements in a compound given its formula? Eg. CH_4		2 Carbon Hydrogen
2.	What are the number of atoms in this formula? Eg. CH_4		5
3.	What are the number of atoms of each element in this formula? Eg. CH_4		1 x Carbon 4 x Hydrogen
4.	How can you tell whether something is an element or a compound from its formula?		An element has one capital letter (ie. One element) A compound has multiple capital letters (ie. More than one element)
5.	What is a molecule?		More than one atom joined together
6.	What is an ion?		An element with a charge (either + or -) with an excess or fewer electrons
7.	What are the names of the 2 types of chemical bonding?		Ionic bonding Covalent bonding
8.	What is ionic bonding?		The attraction between a positive ion and a negative ion
9.	What is covalent bonding?		The sharing of a pair of electrons
10.	How do you make a symbol equation balanced?		The number of atoms in reactants and products either side of the 'arrow'
11.	What is the formula of calcium carbonate?		$CaCO_3$
12.	What is the formula of carbon dioxide?		CO_2
13.	What is the formula of hydrogen?		H_2
14.	What is the formula of water?		H_2O
15.	What is the formula of hydrochloric acid?		HCl
16.	What is the formula of sulfuric acid?		H_2SO_4
17.	What is the formula of calcium chloride?		$CaCl_2$
18.	What is the formula of magnesium chloride?		$MgCl_2$
19.	What is the formula of magnesium sulfate?		$MgSO_4$
20.	How are positive ions formed?		When electrons are lost from atoms
21.	How are negative ions formed?		When electrons are gained by atoms
Rate of a reaction			
22.	Give an example of a slow reaction and a fast reaction		Rusting is a slow reaction Burning and explosions are very fast reactions
23.	What apparatus would be useful to measure the rate of reaction producing a gas?		A gas syringe collected the gas from a flask
24.	Why does a reaction stop?		The number of reactants have been used up to make a product.
25.	What is the rate of reaction?		Measures how much product is formed in a fixed time period.
26.	What are common units for the rate of reaction?		g/s or g/min cm^3/s or cm^3/min
27.	In terms of a limiting reactant, how much product is formed?		The amount of product formed is directly proportional to the amount of limiting reactant used.

28.	What is the limiting reactant?		The reactant not in excess and therefore is ALL used up at the end of the reaction.
29.	What is meant by the amount of product formed in a reaction is directly proportional to the amount of limiting reactant used?		The graph is straight Has a positive gradient Passes through the origin (0,0)
30.	Why is the amount of product formed in a reaction directly proportional to the amount of limiting reactant used?		Reactions happen when particles collide with enough energy. The more reactant particles there are, the more product can be formed.
31.	When does a chemical reaction take place?		When reactant particles collide
32.	What effect does increasing the temperature have on the rate of a chemical reaction? Why?		Increases rate of reaction Particles have more kinetic energy The frequency of collisions increases The amount of successful collisions (meeting activation energy threashold) increases Therefore the rate of reaction increases
33.	What effect does increasing the concentration have on the rate of a chemical reaction? Why?		Increases the rate of reaction There are more particles so the frequency of collisions increases Therefore the rate of reaction increases
34.	What effect does increasing the pressure have on the rate of a chemical reaction of gases?		Increases the rate of reaction In effect, this reduces the space in which particles can move around This therefore increases the chance of collisions and the frequency of collisions Therefore the rate of reaction increases
35.	What does the rate of reaction depend on?		Collision frequency of reacting particles Energy transferred during the collision (whether the collision is successful or effective)
36.	What additional substance can be added to increase the rate of reaction?		A catalyst
37.	Describe an explosion		A very fast reaction which releases a large volume of gaseous products
38.	How can surface area effect the rate of reaction		Increasing the total surface area increases the rate of reaction. Eg. Powdered reactant rather than a lump. This is because there is a greater frequency of collisions between a greater number of particles
39.	Describe a catalyst		A substance which changes the rate of reaction and is unchanged at the end of the reaction
40.	Why is only a small amount of catalyst needed		Only a small amount is needed as the catalyst is not used up in the reaction and so can therefore continue to effect the reaction
41.	Explain the dangers of fine combustible powders in factories eg. flour		There is a large total surface area in contact with oxygen. A spark or light is likely to cause an explosion because there are a large potential frequency of collisions.
Reacting Masses			
42.	How do you work out the relative formula		The relative atomic masses are

	mass (Mr) calculation?		added together in the quantities that are included.
43.	What is the conservation of mass?		The total mass of reactants at the start of a reaction is equal to the total mass of products made.
44.	How would you work out the mass of oxygen produced in a reaction from known relative formula mass?		Work out the relative formula mass of all reactants. Work out the relative formula mass of the product known and take away for the relative formula mass of all reactants.
Percentage yield and atom economy			
45.	What is percentage yield?		A way of comparing the amount of product made (actual yield) to amount expected (predicted yield). The closer to 100% is best.
46.	Why would the percentage of yield of a product be less than 100%?		Loss in filtration Loss in evaporation Loss in transferred liquids Not all reactants reacted to make a product
47.	How can atom economy be used as a way of measuring the amount of atoms wasted?		100% atom economy means that all atoms in the reactant have been turned to the desired product. The higher the atom economy the 'GREENER' the process. – ie. Less waste
48.	Recall use the formula of percentage yield		Actual yield Divided by Predicted yield Multiply by 100
49.	Explain why an industrial process wants as high a percentage yield as possible		Reducing the reactants wasted Reducing cost
50.	Recall and use the formula of atom economy		Mr of desired products Divided by Sum of Mr of all products Multiply by 100
51.	Explain why an industrial process wants as high an atom economy as possible		To reduce the production of unwanted products To make the process more sustainable
Energy			
52.	What is an exothermic reaction?		One which energy is transferred into the surroundings (releases energy)
53.	What is an endothermic reaction		One which energy is taken from the surroundings (absorbs energy)
54.	Describe, using a diagram, a simple calorimetric method for comparing the energy transferred in combustion reactions		Use of spirit burner or a bottled gas burner Heating water in a copper calorimeter Measuring the temperature change Consider fair tests Identify the fuel which releases the most energy in terms of heat
55.	What is the difference between exothermic and endothermic in terms of what happens to bond?		Exothermic = bond making Endothermic = bond breaking
56.	How would you calculate the energy per gram from the energy output of a fuel in J/g?		Energy released (in J) Divided by Mass of fuel burnt (in g)
Batch or Continuous			
57.	Describe differences between a batch and		<u>Batch</u>

	continuous process		Chemicals needed in a small amount or only as needed Production does not go on all the time Product made at the end of the process Cost of factory equipment low Rate of production low Shut-down times often Workforce – many people needed <u>Continuous</u> Large amount made Production goes on all the time Product made throughout the process Cost of factory equipment high Rate of production high Shut-down times rare Workforce – relatively few people needed
58.	List the factors that affect the cost of making and developing a pharmaceutical drug		Research and testing Labour costs Energy costs Raw materials Time taken for development Marketing
59.	Explain why pharmaceutical drugs need to be thoroughly tested before they can be licensed for use		Tested to check they are not toxic Later trialled using human volunteers Potential side effects should show themselves Most substances do not pass all the tests and trials, so drug development is expensive.
60.	Give suggestions of how speciality chemicals such as pharmaceuticals can be made.		Synthetically Extracted from plants
61.	Explain why it is important to manufacture pharmaceutical drugs to be as pure as possible		Reduces changes of unnecessary side effects and helps ensure an accurate dose in each tablet/capsule
62.	Describe how melting point, boiling point and thin layer chromatography can be used to establish the purity of a compound		Impurity lowers the melting point Impurity raises the boiling point Thin layer chromatography shows that the substance produces just one spot on a plate The distance travelled by the substance is identical to a known sample of that substance on the same plate.
63.	Describe how chemicals are extracted from plant sources		Crushing Boiling and dissolving in suitable solvent Chromatography
Allotropes of carbon and nanochemistry			
64.	List the physical properties of diamond		Lustrous, colourless and clear(transparent) Hard and has a high melting point Insoluble in water Does not conduct electricity
65.	List the physical properties of graphite		Black, lustrous and opaque Slippery Insoluble in water Conducts electricity
66.	How are nanotubes used?		Reinforce graphite in tennis rackets because nanotubes are very strong

			Nanotubes are used as semiconductors in electrical circuits
67.	Explain, in terms of structure and bonding, why diamond: Does not conduct electricity Is hard and has a high melting point		• Giant molecular structure • Each carbon atom is covalently bonded to four other carbon atoms. • A lot of energy is needed to separate the atoms in diamond. • Covalent bonds are strong, and diamond contains very many covalent bonds. • There are no free electrons or ions in diamond, so it does not conduct electricity.
68.	Explain, in terms of structure and bonding, why graphite: Conducts electricity Is slippery Has a high melting point		• Giant molecular structure • Covalent bonds very strong – a lot of energy needed to separate atoms • Each carbon is only covalently bonded to 3 other carbon atoms • Graphite is therefore in layers • Layers slide over each other easily because there are only weak forces between them. • Graphite contains delocalised electrons. These can moves around allowing graphite to conduct electricity.
69.	Explain why fullerenes can be used in new drug delivery systems		They are very strong. The Buckminsterfullerene is spherical and contains 60 carbon atoms. Drugs can be contained within these.
70.	Explain how the structure of nanotubes enables them to be used as catalysts.		Have very large surface area. Often able to react very quickly
71.	What is an allotrope?		Forms of an element that exist in the same state (eg. Solid or liquid) but have different properties because their atoms are arranged differently.
72.	What does nano mean?		Very small – 1 billionth of a metre.