Buttershaw Business and Enterprise College

AQA Combined Science Trilogy

Chemistry Paper 2 Higher

Key Recall Facts

Rate and Extent of Chemical Change, Organic Chemistry, Chemical Analysis, Chemistry of the Atmosphere, Using Resources

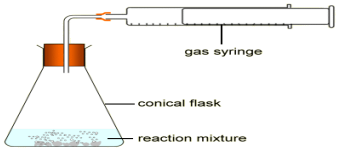
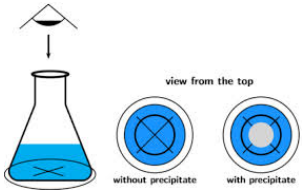
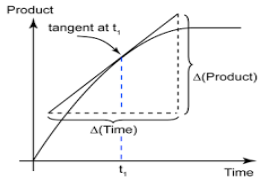
Exam Date – Tuesday 13th June

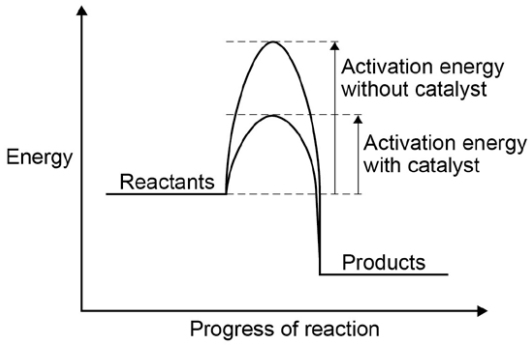
Name……

Group……

Teacher……

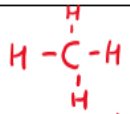
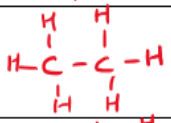
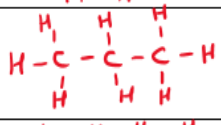
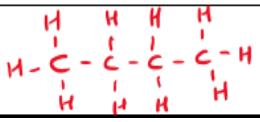
Rate and Extent of Chemical Change Recall Facts

1. Equation for rate of reaction	Amount of product formed/time taken Or Amount of reactant used/time taken
2. What are the units for rate of reaction?	Usually g/s or cm^3/s HT only mol/s
3. How can you measure rate of reaction?	1. By measuring the volume of gas produced in a certain time, using a gas syringe 2. By measuring the change in mass, using a mass balance if one of the products is a gas 3. By measuring how long it takes for a cross to disappear  
4. How to calculate rate of reaction at one point in time? 	• Draw a tangent to the curve at the time mentioned in the question • Use the gradient of the tangent to calculate rate of reaction using • Change in y (product)/change in x (time)
5. What is collision theory?	In order to react, particles ***must collide and must collide with enough activation energy***. If they collide but not with enough energy, they do not react
6. What is activation energy?	Minimum energy needed for a reaction to occur
7. List 5 factors that affect the rate of reaction	• Temperature • Concentration • Surface area • Catalyst • Pressure
8. How does increasing concentration/pressure affect the rate of reaction?	Increasing concentration, increases number of particles in a given volume. This increases the frequency of collisions and increases the rate of reaction.
9. How does increasing temperature affect the rate of reaction?	As the temperature is increased, particles have more kinetic energy (move faster). This increases the frequency of collisions, increasing the rate of reaction. Increasing the temperature also gives more particles activation energy, leading to more successful collisions

10. How does increasing the surface area affect the rate of reaction?	Breaking a solid down into smaller pieces, increases the surface area and number of particles exposed. This increases the frequency of collisions, increasing the rate of reaction.
11. How does having a catalyst increase the rate of reaction?	A catalyst provides an alternative route with a lower activation energy. More particles have activation leading to more successful collisions, increasing the rate of reaction 
12. What are enzymes?	Biological catalysts that speed up reactions inside the body
13. What does the symbol ⇌ represent?	Reversible reaction
14. What is Le Chateliers' principle?	If equilibrium conditions change, then the equilibrium will shift to oppose the change.
15. What is a closed system?	No reactants and/or products can escape
16. What is a dynamic equilibrium?	In a closed system, the forward and backward reaction occur at the same rate. This means that the concentration of reactants and products will not change
17. What happens to the equilibria if we increase one of the reactants?	Equilibrium will shift to the right to oppose this change. So, more products formed
18. What happens to the equilibria if we increase the temperature?	Equilibrium will shift to the endothermic side
19. What happens to the equilibria if you increase the pressure?	Equilibrium will shift to the side with fewer moles
20. How does a catalyst affect equilibria?	A catalyst has no effect on the position of the equilibria However, it allows equilibria to be reached faster, as it speeds up the rate of both forward and backward reactions by the same amount.

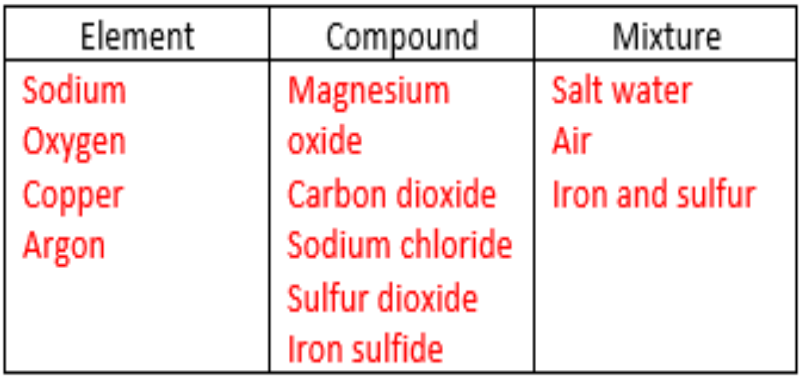
Organic Chemistry

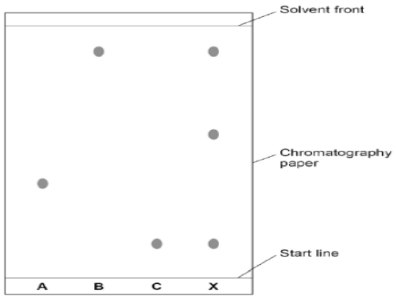
1. Describe how crude oil is formed	• Dead plankton • Buried in mud • Over millions of years
2. What is a hydrocarbon?	Compound made of only carbon and hydrogen atoms
3. What is a homologous series?	Group of organic compounds that react in a similar way
4. Describe the difference between saturated and unsaturated hydrocarbons	Saturated hydrocarbons have single C-C bonds, whilst unsaturated hydrocarbons have double C=C bonds
5. What is a fraction?	A mixture of hydrocarbons with similar number of carbon atoms and boiling points
6. Describe how fractional distillation separates the different fractions in crude oil	• Heated crude oil and turned into vapour. • Enters a column where it is hotter at bottom and cooler at top. • Cools and condenses. • At different levels based on boiling point
7. Name 4 fractions in crude oil and their uses	• Refinery Gases – heating and cooking • Gasoline (petrol) – fuel for cars • Kerosene – fuel for planes • Diesel – fuel for lorries • Heavy fuel oil – fuel for ships • Bitumen – road tarmac
8. Describe and explain the trend between the length of hydrocarbon and boiling point	• As the number of carbon atoms increase, the high the boiling point. • This is because there are stronger intermolecular forces. • So, more energy needed to break forces.
9. Describe the trend between length of hydrocarbon and flammability	As the number of carbon atoms increase, the lower the flammability

<table>
<tr><td>10. Describe the trend between length of hydrocarbon and viscosity</td><td>As the number of carbon atoms increase, the higher the viscosity.</td></tr>
<tr><td>11. Describe the difference between complete combustion and incomplete combustion</td><td>Complete – fuel burnt in lots of oxygen.
Incomplete – fuel burnt in little oxygen.</td></tr>
<tr><td>12. What are the products of complete combustion of a hydrocarbon? Write a word equation for the complete combustion of propane</td><td>Carbon dioxide and water
Propane + oxygen → carbon dioxide + water</td></tr>
<tr><td>13. What are the products of incomplete combustion of a hydrocarbon? Write the word equation for the incomplete combustion of propane</td><td>Carbon monoxide or carbon particulates and water
Propane + oxygen → carbon monoxide + water</td></tr>
<tr><td>14. Balance the symbol equation below. Is this showing complete combustion or incomplete combustion? Explain your answer
__C_3H_8 + __O_2 → __CO_2 + __H_2O</td><td>__C_3H_8 + $5O_2$ → $3CO_2$ + $4H_2O$
Complete combustion as it produces carbon dioxide</td></tr>
<tr><td>15. Give the general formula of alkanes</td><td>C_nH_{2n+2}</td></tr>
<tr><td>16. What is the formula of an alkane with 6 carbon atoms?</td><td>C_6H_{14}</td></tr>
<tr><td>17. Name the first 4 alkanes, draw their displayed formula and write their molecular formula</td><td>
<table>
<tr><th>Number of Carbon Atoms</th><th>Name of Alkane</th><th>Displayed Formula</th><th>Molecular formula</th></tr>
<tr><td>1</td><td>Methane</td><td>  </td><td>CH_4</td></tr>
<tr><td>2</td><td>Ethane</td><td>  </td><td>C_2H_6</td></tr>
<tr><td>3</td><td>Propane</td><td>  </td><td>C_3H_8</td></tr>
<tr><td>4</td><td>Butane</td><td>  </td><td>C_4H_{10}</td></tr>
</table>
</td></tr>
<tr><td>18. Why are alkanes known as saturated hydrocarbon?</td><td>Saturated – contains only single C-C bonds.
Hydrocarbon – contains only hydrogen and carbon atoms.</td></tr>
</table>

19. What is cracking?	Breaking a large hydrocarbon (alkane) into a shorter chain hydrocarbon and an alkene
20. Why is cracking important?	To turn excess longer chains into more desirable shorter alkanes (1) to be used as fuels (1) and alkenes to make polymers/plastics (1)
21. State the two types of cracking and their conditions	Catalytic – use of a catalyst and lower temperatures Steam – mix them with steam at very high temperatures and high pressures
22. Describe an advantage of catalytic cracking	Catalytic cracking is cheaper and more efficient than thermal cracking as it uses a lower temperature and pressure.
23. How are alkenes different from alkanes?	Have at least one double C=C bond
24. Give the use for alkenes	Used to make polymers/plastics, as well as starting material for other chemicals
25. Describe the test for alkenes	Add bromine water Turns orange to colourless

Chemical Analysis

1. In terms of everyday language, what is a pure substance?	A natural substance that has nothing added to it. For example, pure milk
2. What is a pure substance?	A pure substance is a single element or compound. It has a specific melting and boiling point.
3. How can we test the purity of a substance?	Heat it and check melting point (melting point should be fixed and can be checked against textbook)
4. What is a formulation?	Mixture designed as a useful product.
5. Give an example of a formulation and why it is used as a formulation	Calpol – flavours added as a sweetener.
6. Define the term element	Substance that contains only one type of atom on the periodic table.
7. Define the term compound	Substance that contains 2 or more different atoms chemically joined together. Written as two words/elements together e.g., sodium fluoride, nitrogen dioxide.
8. Define the term mixture	Two or more substances mixed but not chemically joined together e.g., air, sea water.
9. Sort the following substances out into elements, compounds and mixtures: - Salt water, Sodium, magnesium oxide, air, carbon dioxide, sodium chloride, oxygen, sulfur dioxide, copper, iron and sulfur, iron sulfide, argon.	
10. How is the melting point of a pure substance different from an impure substance?	An impure substance has a lower melting point And has a range of melting points
11. Why is the start line in chromatography drawn in pencil?	Pencil is insoluble so does not run up the paper.
12. Why does the start line have to be above the solvent in chromatography?	So, the substance being tested does not dissolve into the solvent.

13. If the dot on the pencil line does not move, how could the experiment be changed to separate the solids in the solvent?	Use a different solvent in which the solutes do dissolve
14. What would happen to the Rf value if the solvent is changed?	It would change depending on the solubility/attraction to the mobile phase
15. What is the equation for Rf value?	$R_f = \frac{\text{Distance traveled by solute}}{\text{Distance traveled by solvent}}$
16. What is meant by soluble?	Dissolves in a solvent.
17. What is the stationary phase in chromatography? Explain your answer	Chromatography paper as it does not move
18. What is the mobile phase in chromatography? Explain your answer	Solvent as it moves
19. Explain how chromatography separates different substances (dyes) dissolved in the same solvent	Different substances have different solubilities As the have different forces of attraction to the mobile phase and so move at different speeds up the paper
20. Explain how you could find out the name of an unknown chemical using chromatography	Run the substances up the chromatography paper and calculate Rf value Compare Rf value With the Rf value of known substances
21. Use the diagram below to answer the questions below.  a) How can you tell A is a pure substance? b) How can you tell X is a mixture? c) Give 2 more conclusions about dye X	a) Only one dot/spot b) More than one dot in the same vertical column c) Contains dyes B and C Does not contain dye A Contains an unknown dye.

22. Describe the test for hydrogen	• Lighted splint • Squeaky pop
23. Describe the test for oxygen	• Glowing splint • Relights
24. Describe the test for carbon dioxide	• Bubble gas through limewater • Turns cloudy.
25. Describe the test for chlorine	• Place damp litmus paper in gas • Bleaches (turns white)

Chemistry of the Atmosphere

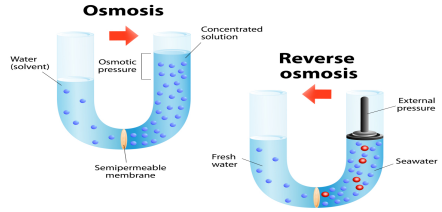
1. Name the 4 gases in the atmosphere today including their percentages	• Nitrogen – 78% • Oxygen – 21% • Carbon dioxide – 0.04% • Argon and other gases – 1%
2. How does carbon get trapped inside coal?	• Trees take in carbon dioxide for photosynthesis. • Trees die. • Get trapped in mud. • Over millions of years.
3. Why was the early atmosphere predominantly made from carbon dioxide and water vapour?	Due to intense volcanic activity
4. What led to the formation of the oceans and seas?	• Temperature on Earth cooled, • Water vapour cooled and condensed to form oceans and seas.
5. Describe 2 ways by which the amount of carbon dioxide on Earth decreased from Early Earth	• Plants/algae photosynthesise. • Dissolved in oceans. • Trapped/locked inside sedimentary rocks/carbonates.
6. Why did the amount of oxygen increase?	Plants/algae photosynthesise.
7. Why did the amount of nitrogen increase?	• Nitrogen unreactive so builds up. • Ammonia (NH_3) oxidised to nitrogen.
8. Name the 3 greenhouse gases	• Carbon dioxide • Methane • Water vapour
9. Describe the greenhouse effect	• Short wavelength radiation from the Sun goes through atmosphere. • Absorbed by Earth's surface and re-emitted. • At a longer wavelength. • Longer wavelength is absorbed by greenhouse gases causing Earth to warm up.
10. What is the carbon footprint?	The total amount of carbon dioxide emitted by a product/service during its life cycle.

11. How has the composition of the atmosphere changed over the last 200 years?	Amount of carbon dioxide has increased
12. List some ways to help reduce carbon footprint	• Alternative energy resources • Energy conservation e.g. less heat loss from homes • Carbon capture/storage • Carbon-neutral fuels • Carbon tax/licenses on use of fossil fuels • Cut waste
13. List some problems with reducing carbon footprint	• Lack of technology on reliable alternatives • Scientific Disagreement • Economic considerations • Countries not cooperating • Hesitant to change lifestyle • Lack of public knowledge/education
14. Why have the levels of methane increased?	• Agriculture – more farm animals producing methane through digestion • Decomposition of waste in agriculture/landfill sites
15. Describe 4 negative impacts of climate change	• Melting ice caps • Sea levels rising • Destruction of habitats leading to extinction • Droughts and desertification • Spread of diseases like malaria • Change in migration patterns of species e.g., birds migrating
16. Describe how carbon dioxide is formed	Complete combustion of fuels using lots of oxygen
17. What are the effects of an increase in carbon dioxide?	Global warming
18. Describe how carbon monoxide and carbon particulates are formed	Incomplete combustion of fuels using little oxygen
19. What is the effect of carbon monoxide?	Colourless, odourless and poisonous gas that stops red blood cells carrying oxygen
20. What is caused by carbon particulates (soot)?	• Asthma • Global dimming/smog • Dirties buildings
21. Describe how sulfur dioxide is formed	Sulfur in the fuel reacts with oxygen at high temperatures

22. What are the effects of increased sulfur dioxide in the air?	• Acid rain • Reacts with old buildings made from limestone. • Kills aquatic life.
23. Describe how oxides of nitrogen are formed	Nitrogen in the air reacts with oxygen at high temperatures
24. What are the effects of increased oxides of nitrogen in the air?	• Acid rain • Asthma
25. Describe the effect a catalytic converter in a car has on air pollutants	• Turns more harmful gases (nitrogen oxides and carbon monoxide) to less harmful gases (nitrogen and carbon dioxide)

Using Resources

1. What do we use the Earth's natural resources for?	a. Warmth b. Shelter c. Food d. Transport
2. Why do we adapt and improve some of the Earth's natural resources?	To make synthetic resources that have improved properties. For example, rubber from tree sap is vulcanised to form car tyres
3. What is a renewable resource?	Renewable resources can be reformed faster, or at the same rate, that we use them.
4. Example of a renewable resource	Timber and food
5. What is a finite resource	Cannot be formed quickly enough to replace them at the rate they are being used
6. What is sustainability?	Using resources to meet the demands of today without affecting the needs of people in the future.
7. How do we reduce the use of resources?	Re-use and recycle
8. How are metals/glass and plastic recycled?	• Separated using an appropriate method (magnets for metals, colours for glass) • Melted • Recast/reformed/remoulded into new product
9. What is the LCA? Life cycle assessment	Looks at every stage of the product's life to assess the impact it has on the environment
10. What 4 things does the LCA consider?	**Getting the raw materials and processing them** Energy used in extraction? Energy used in processing? **Manufacture and packaging** Energy required, pollution, how are waste products disposed of? **Using the product** Lifespan of product, does the product damage the environment **Disposal of a product**
11. How can we dispose of a product?	• Landfill - takes up space, maybe non-biodegradable (does not break down naturally) • Energy transporting waste • Incinerating product – some energy can be obtained from this, but could release harmful chemicals as pollution

12. What are the disadvantages of LCA?	Some companies may only use certain parts of the LCA, leading to bias and positive advertising Some impacts on the environment are difficult to quantify
13. What is potable water?	This is water that is safe to drink – not pure as it will contain dissolved substances
14. State the properties of potable water	• Very little to no microbes • Little dissolved salts • pH between 6.5 and 8.5
15. How is potable water obtained in the UK?	From freshwater and groundwater (lakes, rivers and underground streams)
16. Describe how potable water is obtained from freshwater and groundwater	• Filtration - This water is passed through filter beds i. wire mesh to remove large objects, such as twigs and rock ii. sand and gravel filter beds removes more fine solid particles • Then, sterilised with chlorine, ozone or UV to kill microbes
17. Define the term sterilise	Kills pathogens
18. What is desalination?	Removing high levels of salt from sea water to obtain potable water. Used in countries where there is little freshwater and groundwater
19. State the 2 methods of desalination	Reverse osmosis and distillation
20. How is potable water obtained by distillation?	Distil the sea water, water evaporates first, condense back to pure water and leave salts behing in the flask
21. How is potable water obtained by reverse osmosis? 	Pressure used to pass salty water through a partially permeable membrane. Water small enough to pass through, but salt left behind.
22. How would you test pure water?	Boiling point should be 100°C Anhydrous copper sulfate → goes from white to blue
23. Describe disadvantages of distillation and reverse osmosis	• Large amount of energy, and so are expensive for producing huge quantities of potable water. • Use of energy may release carbon dioxide contributing to global warming • Countries that are poor and lack of fresh water can't afford it.

24. Where does wastewater come from?	• Industry – industrial wastewater contains harmful chemicals • Toilet water (sewage) – human waste, sinks, baths and showers contain organic matter and harmful chemicals • Agricultural wastewater – contains organic matter and harmful chemicals
25. How to treat wastewater?	**Screening and grit removal** - removes large solids from wastewater **Sedimentation** – removes human waste from rest of water (effluent). Heavier sludge sinks to the bottom, and effluent floats at the top **Aerobic treatment of effluent** – good bacteria kill bad bacteria (break down organic matter) in the presence of oxygen **Anaerobic treatment of sludge** (waste from sedimentation) – bacteria produce methane from sludge
26. State 2 alternative methods of extracting metals from low percentage ores	• Phytomining • Bioleaching
27. Describe how copper can be extracted by phytomining	• Plants grown in soil containing copper compounds • Plants absorb copper compounds when they grow • Harvest and burn them into ash • React with sulfuric acid to form copper sulfate solution • Electrolysis of solution to form copper or displacement reaction with scrap iron
28. Describe how copper can be extracted by bioleaching	• Bacteria are used that produce leachate solutions that contain metal compounds • Electrolysis of solution to form copper or displacement reaction with scrap iron
29. Why is displacement preferred to electrolysis?	Cheaper due to greater energy requirement of electrolysis
30. Why are these methods used for low metal ores over traditional methods of carbon extraction and electrolysis?	These methods are more cost effective and may have less impact on the environment. However, they are much slower