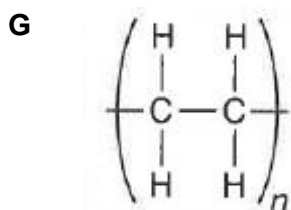
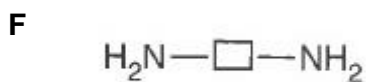
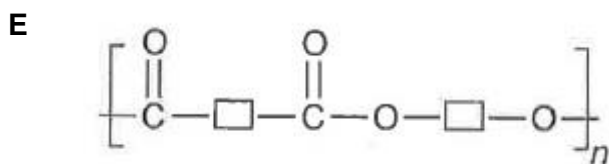
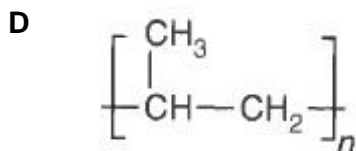
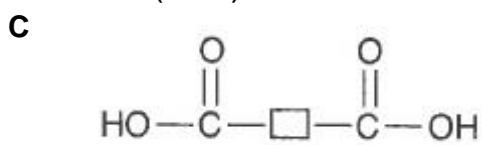
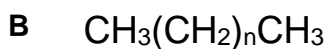
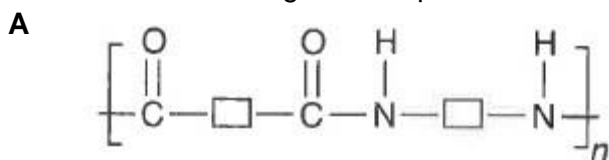


## Section A

Answer all question in this section in the spaces provided  
The total mark for this section in 50.

**2019 O level P2**

- 1 (2019/O/GCSE/P2/01) Organic polymers The diagrams can be used to represent the structures of some organic compounds.



Use the letters A, B, C, D, E, F and G to answer the questions.

Each letter may be used once, more than once or not at all.

- (a) Which diagrams show the structure of an addition polymer?

[1]

(b) Which compounds are formed in condensation reactions?

[1]

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(c) Which compound can be used in reactions to form both polyamides and polyesters?

[1]

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(d) Which structure represents the repeating unit of a macromolecule used to make clingfilm

[1]

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(e) Which structure represents the polymer which is most commonly used to make fishing line?

[1]

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[Total: 5]

2 (2019/O/GCSE/P2/02) Atomic structure Table 2.1 shows information about three isotopes of element X.

Table 2.1

isotopes	Element X		
	1	2	3
Number of protons	16	16	16
Number of neutrons	13	14	15
Number of electrons	16	16	16
Number of electrons in outer shell	6	6	6

(a) Use data from the table to show that 1, 2 and 3 are isotopes of the same element

[2]

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(b) Explain how the data suggests that the three isotopes have the same chemical reactions.

[1]

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- (c) Element Y and element Z also have isotopes  
 Table 2.2 shows information about an isotope of element Y and an isotope of element Z.

Table 2.2

	Isotope of element Y	Isotope of element Z
Number of protons	8	30
Number of neutrons	7	34
Number of electrons	8	30
Number of electrons in outer shell	6	2

- (i) Use the information in table 2.1 and 2.2 to identify the elements X, Y and Z.

X

---

Y

---

Z

[1]

- (ii) Suggest the trend in the melting points of elements X, Y, and Z

Lowest melting point

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Highest melting point

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Explain your reasoning

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[3]

- (iii) Which of the elements X, Y or Z reacts with acids to make salts?  
Explain your reasoning

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[2]

[Total: 9]

- 3 (2019/O/GCSE/P2/03) QA Some lead ores contain gold mixed with impurities which include compounds of lead.

The lead compounds can be removed from the gold by reacting the ore with dilute nitric acid.

- (a) Explain why lead reacts with nitric acid but gold does not.

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[2]

- (b) Dilute hydrochloric acid or dilute sulfuric acid cannot be used to remove compounds of lead.

Explain why dilute nitric acid can be used to remove compounds of lead but these acids cannot be used.

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[2]

- (c) Different metal ores may also contain impurities of compounds of lead, zinc or aluminium.

The reaction of a sample of ore with nitric acid results in the formation of a solution containing one of these metal ions

- (i) Explain why aqueous ammonia can be used to identify only one of the ions in solution.

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[2]

- (ii) Describe another test and result that can be used to distinguish between the other two ions.

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[1]

- (iii) Describe how you would carry out a test to show the presence of nitrate ions in a solution. Include the observations you would expect.

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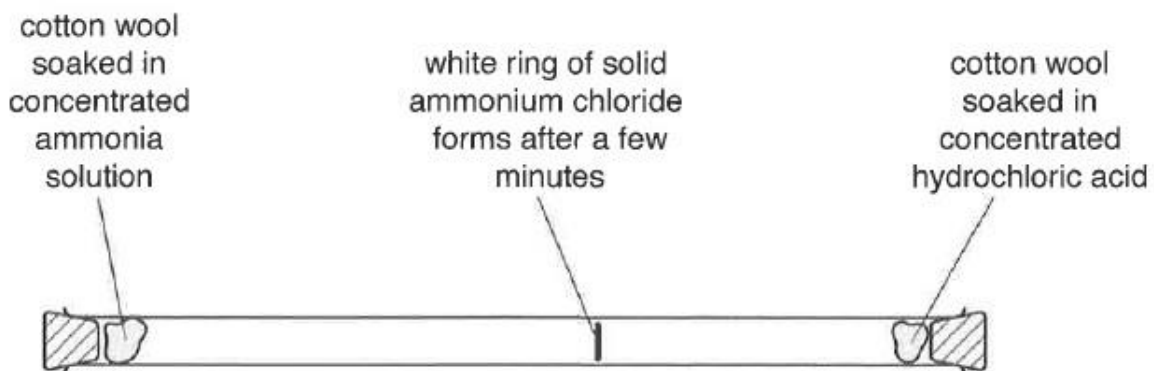
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[3]

[Total: 10]

- 4 (2019/O/GCSE/P2/04) Particle theory The diagram shows an experiment to investigate the rate of diffusion of gases (experiment A)



- (a) Write an equation, with state symbols, to show the formation of solid ammonium chloride.

[2]

- (b) A student measures the distance travelled by each gas from the cotton wool to the white ring.

The results are shown in the table.

	Distance travelled /cm	Mr
NH <sub>3</sub>	60	
HC/	40	

- (i) Complete the table by filling in the Mr for each gas.

[1]

- (ii) The student makes this conclusion:  
 'The rate of diffusion is inversely proportional to the relative molecular mass of each gas'

Do the measurements obtained in the experiment support this conclusion?

Explain your reasoning.

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[2]

- (c) The experiment is repeated at a lower temperature (experiment B)  
 Suggest one similarity and one difference between the observations made in experiment A and experiment B.

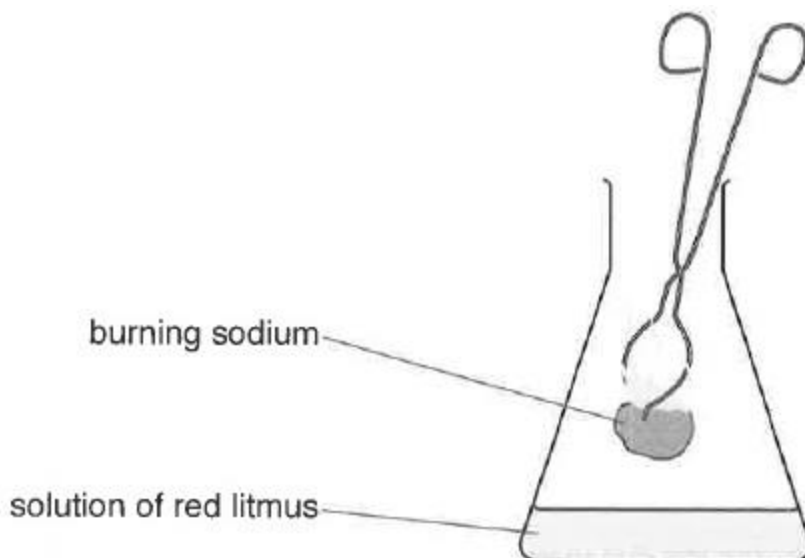
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[2]

- 5 (2019/O/GCSE/P2/05) metals Some elements burn in air to form oxides. In an experiment, burning sodium was held in a flask containing a solution of red litmus indicator. At the end of the experiment, the product of the reaction dissolves in the solution.



In a second experiment, the reaction was repeated using burning sulfur instead of sodium.

- (a) State and explain what you would expect to see happen to the indicator in each experiment.

Experiment using sodium:

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Experiment using sulfur

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[3]

- (b) Sodium oxide,  $\text{Na}_2\text{O}$ , forms during the first experiment. Draw a 'dot-and-cross' diagram to show the arrangement of outer shell electrons in the ions in sodium oxide.

[2]

- (c) The mass of the sodium at the start of the first experiment was 0.50 g.

- (i) Calculate the theoretical yield of sodium oxide,  $\text{Na}_2\text{O}$ .

[2]

- (ii) The table shows the mass of the flask and indicator before and after the experiment.

Mass of flask and indicator at start/g	94.50
Mass of flask and indicator at end/g	94.82

Calculate the percentage yield of sodium oxide

[2]

- (iii) Suggest a reason why the percentage yield is not 100%

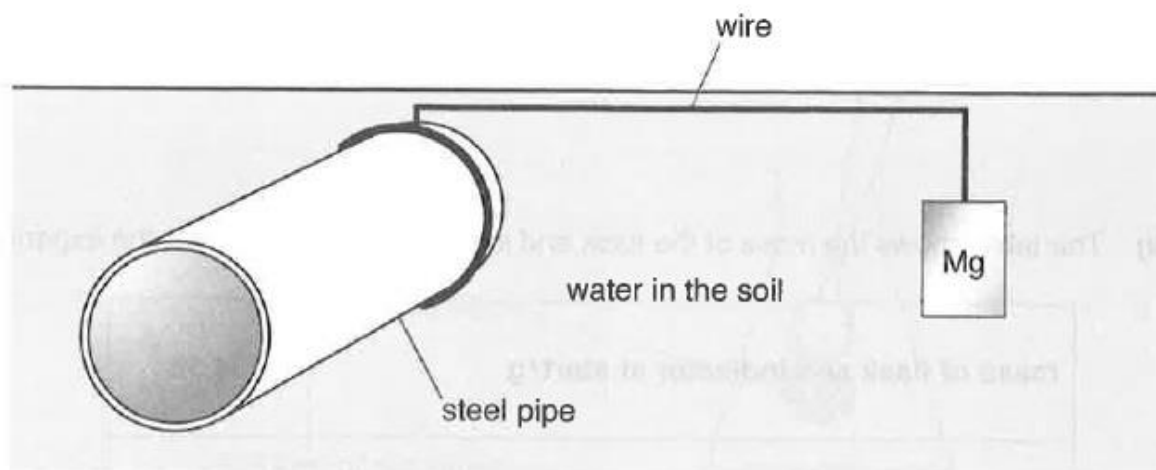
[1]

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[Total: 10]



- 6 (2019/O/GCSE/P2/06) metals Underground steel pipes are used to transport crude oil over long distances.  
The pipes rust easily because they contain iron and are surrounded by water in the soil  
Blocks of magnesium are attached to pipes to prevent rusting.



- (a) Explain how the magnesium protects the pipe from rusting  
Include an ionic half-equation to show what happens to magnesium in your answer.

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[2]

- (b) Oil and paint can also be used to prevent rusting.  
(i) Explain how oil and paint prevent rusting.

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[2]

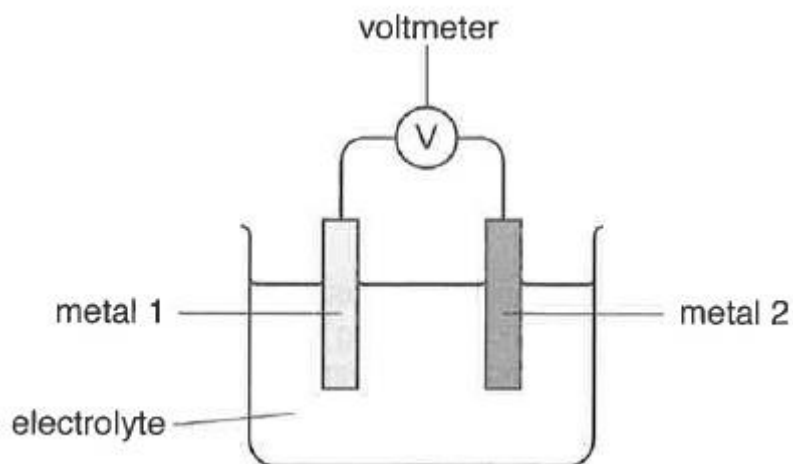
- (ii) Suggest a reason why oil and paint are not suitable for use on underground pipes.

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[1]

[Total: 5]

- 7 (2019/O/GCSE/P2/07) Simple cell Two metal electrodes and an electrolyte can be used to produce electrical energy.



The table shows the voltage produced by some cells when different metals are used.

Metal 1	Metal 2	Voltage/V
Copper	Zinc	1.10
Copper	Nickel	0.60
Silver	Zinc	1.56
Silver	Nickel	1.06
Silver	Iron	1.25

- (a) Explain why different combinations of metals produce different voltages

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[2]

- (b) Suggest the voltages that will be produced when the following metals are used.

Metal 1	Metal 2	Predicted voltage/V
Copper	Iron	
Silver	Magnesium	

[2]

[Total: 4]

## Section B

Answer all three questions in this section

The last question is in the form of an either/or and only one of the alternatives should be attempted

## 8 (2019/O/GCSE/P2/08) Redox

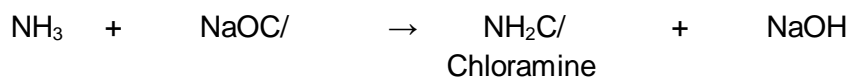
Compounds in bleach

Bleaches are used to remove colour and to sterilise areas where hygiene is important. They are used industry to bleach wood pulp for making paper and flour for marking bread. They are often used to sterilise areas such as bathrooms because they react with and break down organic molecules.

Manufacturing and using hypochlorite bleaches

The most common compound used to make hypochlorite bleach is sodium hypochlorite, which is also known as sodium chlorate (I) is a very unstable solid at room temperature.

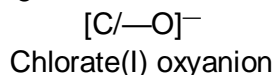
Sodium chlorate (I) is an oxidising bleach which is used to clean toilets and to kill bacteria in swimming pools. Human waste often contains ammonia. Sodium chlorate (I) reacts with ammonia by substituting a hydrogen atom with chlorine to form chloramine



Chloramine reacts with sodium chlorate (I), then the product formed reacts further with sodium chlorate (I) to form nitrogen trichloride. Compounds of nitrogen with chlorine are irritating and toxic to people

Other chlorine based bleaches

Sodium chlorate (I) is not the only hypochlorite bleach. All hypochlorite bleaches contain the chlorate (I) oxyanion. The oxyanion contains a covalent bond between the oxygen and chlorine atoms. Both atoms in the ion have a stable octet electron arrangement because the ion also has an overall negative charge.

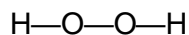


Calcium hypochlorite, which is also known as calcium chlorate (I), has two main advantages. Firstly, it is a stable solid, so can be used to make powdered bleaching products for cleaning. Secondly, the percentage by mass of chlorate (I) ions in calcium chlorate (I) is greater than the percentage by mass of chlorate (I) ions in sodium chlorate (I)

A different type of oxidising bleach

Hydrogen peroxide.  $\text{H}_2\text{O}_2$ , is another compound which is used to make bleaches. It oxidises and breaks down compounds and produces water. Hydrogen peroxide is used to bleach hair and to sterilise wounds.

Hydrogen peroxide is an unusual compound because the oxidation state of oxygen in the compound is  $-1$



Sodium peroxide and calcium peroxide are also used as bleaches and disinfectants

**(a)** Suggest reasons why the chlorate(I) ion is referred to as an 'oxyanion'

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[1]

**(b)**

**(i)** Write an equation for each of the two reactions which lead to the formation of nitrogen trichloride from chloramine

[1]

**(ii)** Deduce the oxidation states of nitrogen in each compound in these equations and hence show that sodium chlorate (I) acts as an oxidising agent.

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[3]

**(c)** Draw a 'dot-and-cross' diagram to show the arrangement of outer shell electrons in a chlorate (I) oxyanion

[2]

- (d) Show by calculation that the percentage by mass of chlorate (I) ions in calcium chlorate (I) is greater than percentage by mass of chlorate (I) ions in sodium chlorate (I)

[3]

- (e) Deduce the formula for calcium peroxide

[1]

- (f) Give a reason why hypochlorite bleaches can cause people to have adverse reactions but hydrogen peroxide bleaches are less likely to do so.

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[1]

[Total: 12]

- 9 (2019/O/GCSE/P2/09) air Palladium is a very expensive metal which is used in catalytic converters

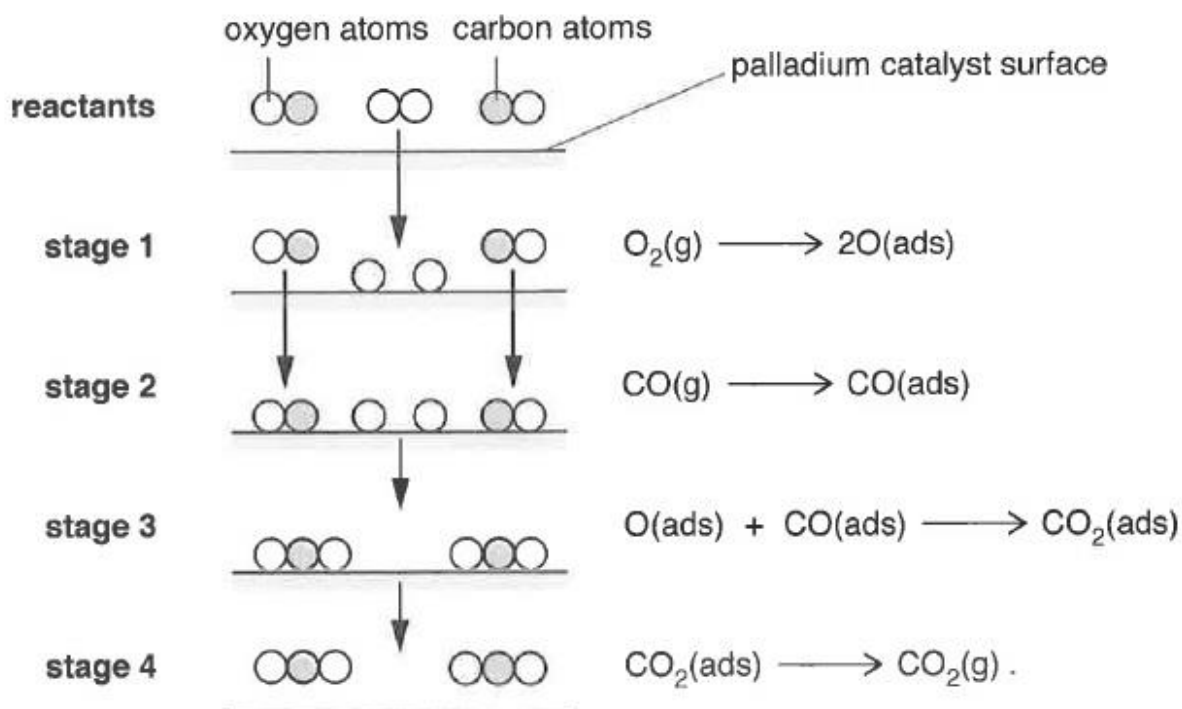
In the converter, palladium catalyses the reaction of oxygen molecules with carbon monoxide molecules to form carbon dioxide.

The molecules become attached to the catalyst surface. This is called adsorption.

On the catalyst surface, some bonds break and atoms are brought close together so that new bonds form.

The diagram shows the stages in the reaction

The state symbol (ads) means an adsorbed atom or molecule.



- (a) Complete the description for what happens during each stage

Stage 1: Oxygen gas molecules adsorb onto the surface of the catalyst, where oxygen bonds breaks to form oxygen atoms.

Stage 2:

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Stage 3:

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Stage 4:

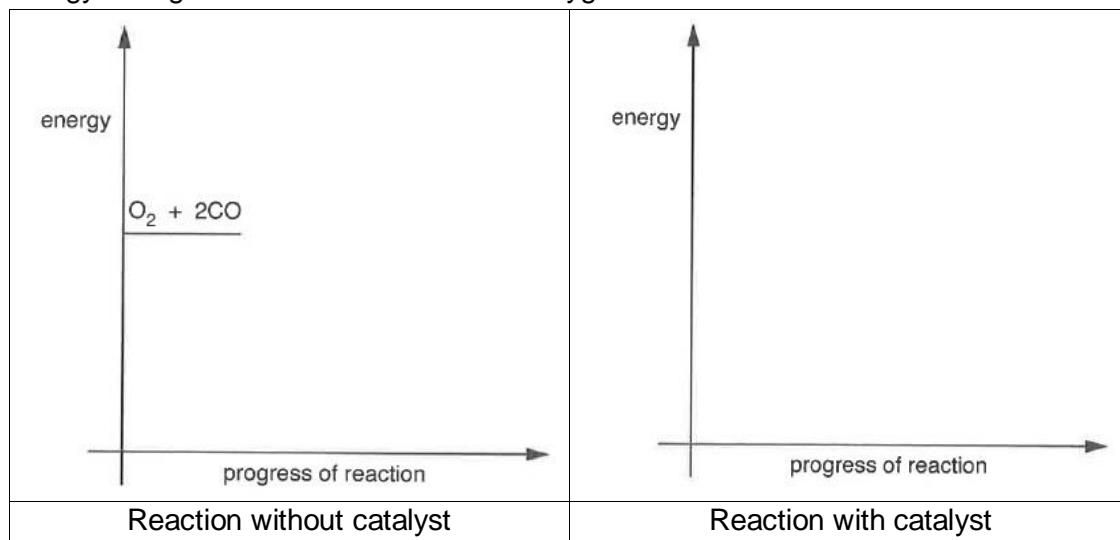
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[3]

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(b) The reaction between oxygen and carbon monoxide is an exothermic reaction.

Complete and label the energy profile diagrams to show the effect of the catalyst on the energy changes in the reaction between oxygen and carbon monoxide.



[3]

(c) Without the catalyst, the reaction between oxygen and carbon monoxide is very slow.

Explain, in terms of collisions and energy, why using a palladium catalyst increases the rate of this reaction.

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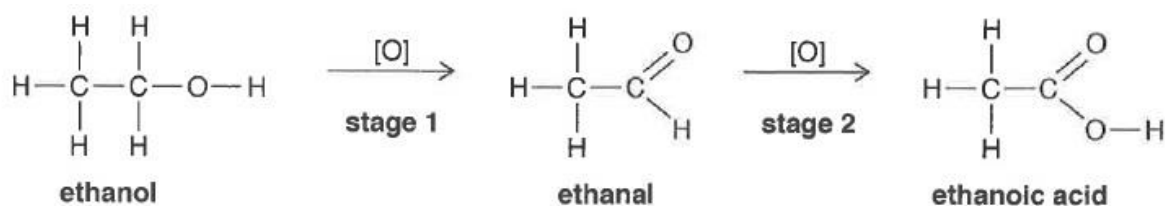
[2]

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[Total: 8]

## Either organic chem acids

- 10** (2019/O/GCSE/P2/10) The oxidation of ethanol to ethanoic acid happens in two stages. The diagrams show the organic product that forms at the end of each stage. The [O] represents an oxygen atom from an oxidising agent.



- (a) Name two substances that can oxidise ethanol to ethanoic acid.

\_\_\_\_\_ and \_\_\_\_\_ [2]

- (b)

- (i) Ethanol and ethanoic acid are each the second member of a different homologous series. Complete the table to show the name and formula of the third member of each series.

Name of series	Alcohols	Carboxylic acids
Name of third member		
Displayed formula of third member		

[2]

- (ii) Ethanal is the second member of the aldehydes homologous series. Deduce the displayed formula of the first member of this series.

[1]



- (c) Ethanoic acid is manufactured in a process which reacts methanol with carbon monoxide.

The equations show the stages in the process.



- (i) Write an overall equation for the process.

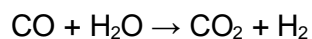
[1]

- (ii) Identify the catalyst in the process  
Explain answer.

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[2]

- (d) The equation below shows an unwanted reaction that happens during the process.



- (i) What effect will this reaction have on the yield of ethanoic acid?  
Explain your reasoning

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[1]

- (ii) Suggests how one of the products of this unwanted reaction could be used.

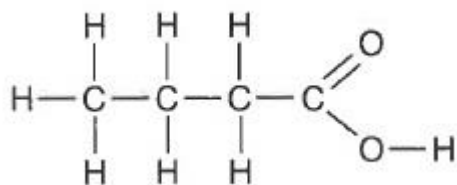
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[1]

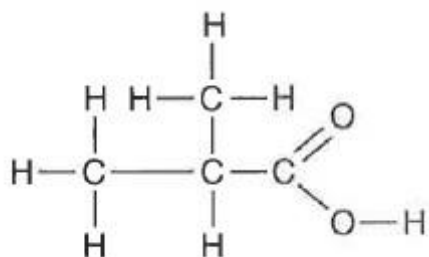
[Total: 10]

OR organic chem isomers

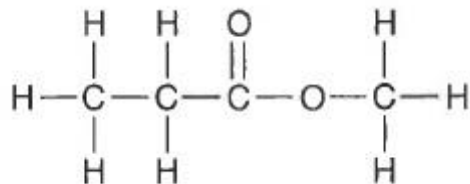
11 (2019/O/GCSE/P2/11) The diagrams show the structures of three isomers.



Isomer 1



Isomer 2



Isomer 3

- (a) The pH of each isomer is tested with universal indicator  
One of the isomers is neutral  
Describe and explain the results you would expect when the pH of each isomer tested with Universal Indicator

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[3]

- (b) Isomer 3 can be made by reacting a carboxylic acid with an alcohol.  
Draw the displayed formulae and give the names of the carboxylic acid and the alcohol that react to form isomer 3

[3]

- (c) Another compound, R, is from the same homologous series as isomer 1. Compound R contains 62.1% carbon and 10.3% hydrogen by mass.
- (i) Deduce the empirical formula of compound R.  
Show your working

- (ii) Deduce the molecular formula for compound R. [3]

[1]

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[Total: 10]