Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Chemistry (1CH0) Foundation

Resource Set Topic N – Test 2: Separate Chemistry 2 (F tier only)

Questions

(Public release version)

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

7 (a) Figure 10 shows information about a glass, a ceramic, a polymer and a metal.

	glass	ceramic	polymer	metal
flexibility	low	low	high	high
hardness	medium	medium	low	low
reaction with water	no reaction	no reaction	no reaction	very slow reaction
electrical conductivity	low	low	low	high
melting point	high	high	medium*	high

*polymers soften, rather than melt, when heated.

Figure 10

Figure 11 shows part of a household wire that connects a kettle to a plug.

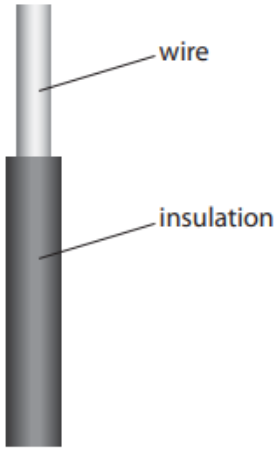


Figure 11

(i) Why is this wire made of metal?

(1)

- ☐ **A** the metal is hard
- ☐ **B** the metal reacts with water
- ☐ **C** the metal is an element
- ☒ **D** the metal conducts electricity

(ii) Which type of material would be most suitable for the insulation on this household wire?

(1)

- ☒ **A** the glass
- ☒ **B** the ceramic
- ☒ **C** the polymer
- ☒ **D** the metal

(b) Explain, using information from Figure 10, why the ceramic is a suitable material to make a cup that will contain a hot drink of tea or coffee.

(2)

Ceramic has a high melting point and does not react with water present in the hot drink.

(c) (i) The structure of a molecule of a polymer is shown in Figure 12.

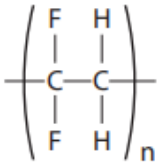
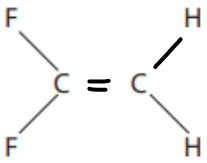


Figure 12

Complete the structure of a molecule of the monomer used to make this polymer by adding the missing covalent bonds.

(2)



*(ii) Poly(ethene) has many uses in everyday life.
Large amounts of poly(ethene) are manufactured from ethene produced by cracking fractions obtained from crude oil.

Poly(ethene) is used to make many objects.
After use it is necessary to dispose of the large amounts of poly(ethene) in these objects.

Explain some of the problems associated with the manufacture and disposal of poly(ethene).

(6)

Crude oil, which ethene is obtained from, is a finite resource. Poly(ethene) is not biodegradable and need to be disposed into landfill sites. Poly(ethene) takes up space in landfill sites. They can also be incinerated. Carbon dioxide, which is a greenhouse gas, is produced during combustion, and this adds to global warming. Other toxic gases are also released and need to be treated before being released into the environment.

10 Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 15.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

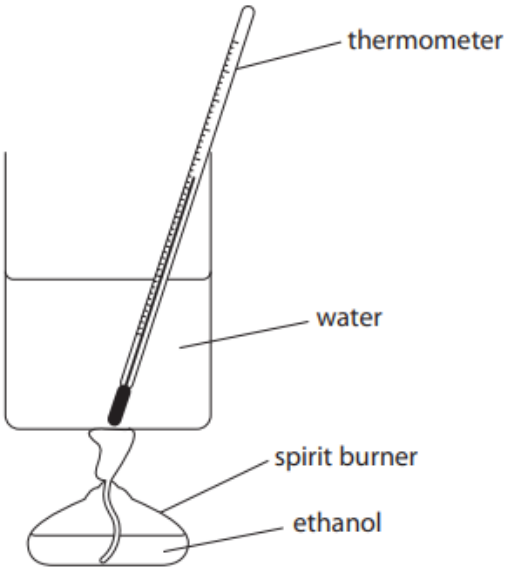


Figure 15

(a) The theoretical temperature rise for burning a given mass of ethanol is 82.4 °C.

In the experiment the actual temperature rise for burning this mass of ethanol was only 34.8 °C.
One reason why the temperature rise is less than expected is that the ethanol does not burn completely.

(i) Give a reason why, even if the ethanol burns completely, the actual temperature rise is much less than the theoretical value.

(1)

heat is lost to the environment

(ii) Explain how the method described above could be improved to give a temperature rise closer to the theoretical value.

(2)

Insulate the walls of the metal can and cover the can with a lid to reduce heat loss to the environment.

(iii) The amount of heat energy used to raise the temperature of the water by 34.8 °C can be calculated using

heat energy = 210 × temperature rise

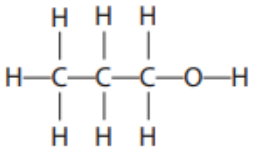
Calculate the amount of heat energy used.

(2)

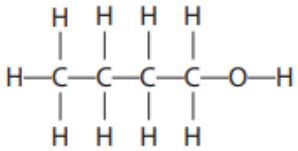
210 x 34.8 = 696

heat energy = 696 (energy units)

(b) Propanol and butanol are both members of the same homologous series as ethanol.



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 15.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1 same functional group (-OH)

reason 2 have general formula of $C_nH_{2n+1}OH$

reason 3 similar chemical properties

(c) Ethanol can oxidise when exposed to air to produce ethanoic acid and water. Propanol can also oxidise in a similar reaction when it is exposed to air.

(i) Write the word equation for the reaction when **propanol** oxidises when it is exposed to air.

(2)

propanol + oxygen → propanoic acid + water

(ii) What is the formula of the functional group in carboxylic acids?

(1)

☒ **A** –OH

☒ **B** $-CH_3$

☒ **C** –COOH

☒ **D** $-CO_2$

3 Polymer molecules can be made by joining together large numbers of small molecules called monomers.

(a) Figure 5 shows the names and structures of some polymers and the monomers used to make them.

Complete the table using the information given.

(3)

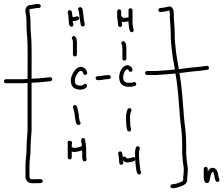
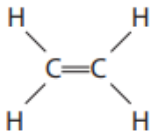
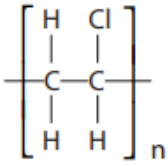
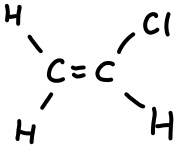
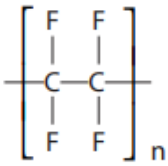
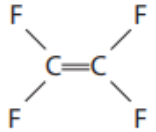
name of polymer	structure of polymer molecule	name of monomer	structure of monomer molecule
poly(ethene)		ethene	
poly(chloroethene)		chloroethene	
poly(tetrafluoroethene)		tetrafluoroethene	

Figure 5

(b) Plastics are polymers.

State **two** problems caused by the disposal of polymers.

(2)

1 combustion releases carbon dioxide, which is a greenhouse gas

2 not biodegradable, takes up landfill site

(c) A molecule of propene has the structure shown in Figure 6.

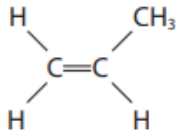
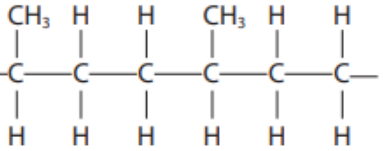


Figure 6

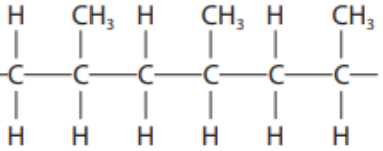
Which of the following shows the structure of part of a poly(propene) molecule?

(1)

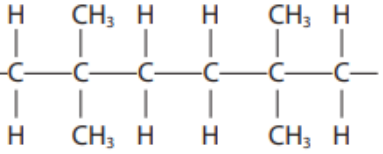
☒ **A**



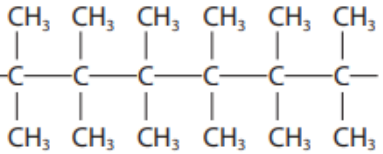
☒ **B**



☒ **C**



☒ **D**



(d) Calculate the relative formula mass of the poly(propene) molecule made from joining together 24600 molecules of propene, C_3H_6.
(relative formula mass: $C_3H_6 = 42.0$)

Give your answer to three significant figures.

(2)

24600 × 42 = 1033200

≈ 1030000

relative formula mass = 1030000

5 (a) Propene can be produced by the cracking of some hydrocarbons obtained from crude oil.

The equation shows the cracking of one molecule of decane to produce one molecule of butene and one molecule of another product.

$$C_{10}H_{22} \rightarrow C_4H_8 + C_xH_y$$

decane butene

(i) Calculate the values of x and y in C_xH_y.

(2)

x = 6 y = 14

(ii) State the total mass of products formed if 25 g of decane is cracked in this way.

(1)

25 g

(b) The structure of a molecule of ethene is shown in Figure 8.

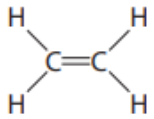


Figure 8

(i) Figure 9 shows the incomplete dot and cross diagram for a molecule of ethene.

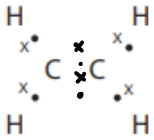


Figure 9

Complete Figure 9 to show the electrons of the C═C double bond.

(1)

(ii) The incomplete combustion of ethene in air produces water as one of the products.

Give the name of another product of the incomplete combustion of ethene.

(1)

carbon monoxide

(c) Substance X is an unsaturated hydrocarbon.
The structure of a molecule of substance X is shown in Figure 10.

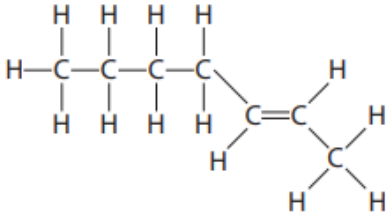


Figure 10

Explain how the structure of substance X shows that it is an **unsaturated hydrocarbon**.

(2)

Substance X only contains hydrogen and carbon so it is a hydrocarbon.

There is a double bond so it is unsaturated.

(d) Two liquid hydrocarbons, **A** and **B**, were tested with bromine water.
One hydrocarbon was known to be an alkane.
The other hydrocarbon was known to be an alkene.

Each hydrocarbon was shaken with a few drops of bromine water.

The results of the tests were
hydrocarbon A + bromine water: the mixture turned from orange to colourless.
hydrocarbon B + bromine water: the orange colour remained.

Explain these results.

(2)

Hydrocarbon A is an alkene so it reacts with bromine water. Hydrocarbon B is an alkane so it does not react with bromine water.

10 (a) Ethanol is made by fermentation of a carbohydrate dissolved in water, in the presence of yeast.

The reaction is carried out at 30 °C.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

The high temperature will kill the yeast needed for fermentation.

(b) Ethanol, C_2H_5OH, can be converted into ethanoic acid, CH_3COOH.

(i) In this reaction ethanol is

(1)

☐ **A** hydrated

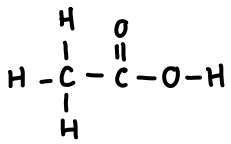
☒ **B** oxidised

☐ **C** polymerised

☐ **D** reduced

(ii) Draw the structure of a molecule of ethanoic acid, CH_3COOH, showing all covalent bonds.

(2)



(c) (i) The apparatus in Figure 16 can be used to investigate the temperature rise produced in a known mass of water when a sample of ethanol is burned.

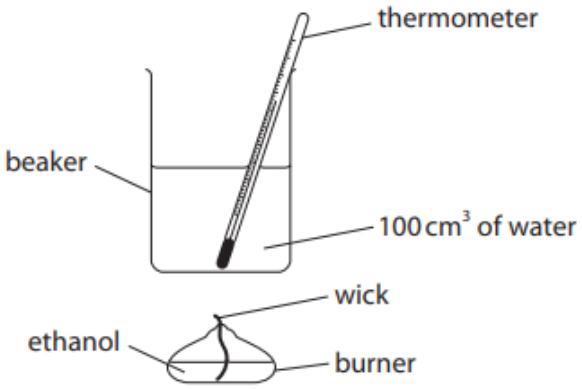


Figure 16

The first steps of the method are

1. put 100 cm^3 of water into a beaker
2. determine the mass of the burner containing ethanol
3. measure the initial temperature of the water
4. place the burner under the beaker of water
5. light the wick

Describe the remaining steps of the method that are needed to determine the mass of ethanol required to raise the temperature of the water by 30 °C.

(3)

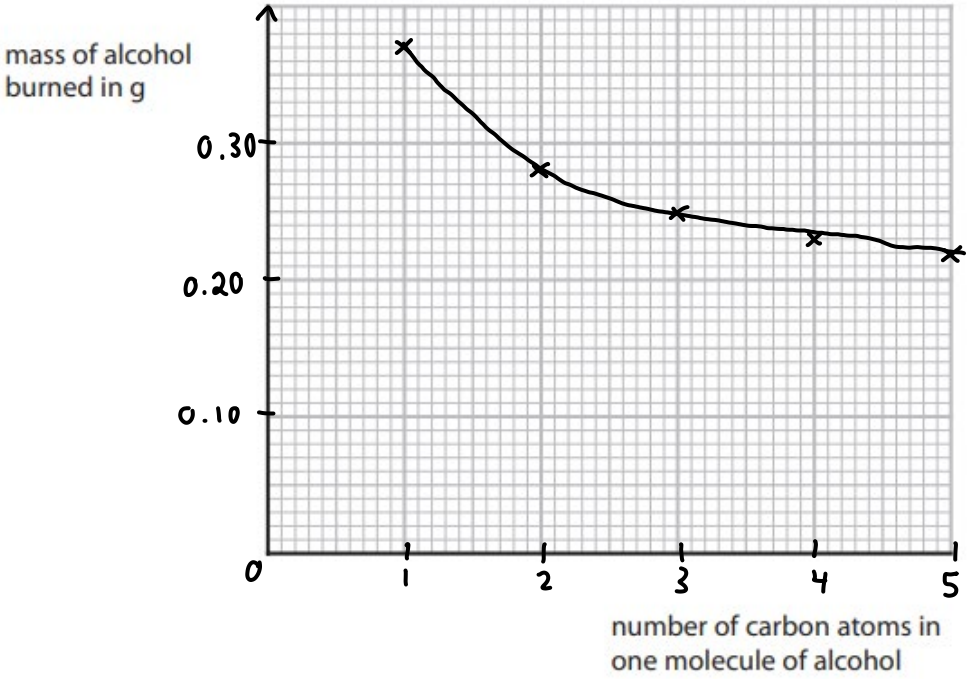
When the temperature has rised by 30°C, entinguish the flame. Determine the mass of the burner containing the remaining ethanol. Deduct the final mass from the initial mass.

(ii) In a different experiment, separate samples of the alcohols methanol, ethanol, propanol, butanol and pentanol were burned to determine the mass of each alcohol that needs to be burned to raise the temperature of 100 cm^3 water by 10 °C.

alcohol	number of carbon atoms in one molecule of alcohol	mass of alcohol burned in g
methanol	1	0.37
ethanol	2	0.28
propanol	3	0.25
butanol	4	0.23
pentanol	5	0.22

Draw a graph of the mass of each alcohol required to raise the temperature of 100 cm^3 of water by 10 °C against the number of carbon atoms in one molecule of that alcohol.

(3)



2 (a) Figure 2 shows information about three different materials, a composite, a glass and a metal.

	a composite	a glass	a metal
density	low	high	high
ability to conduct electricity	poor	poor	good
resistance to corrosion	good	good	poor

Figure 2

Explain which material in Figure 2 is the most suitable material to use in electrical circuits.

(2)

A metal. It has a good conductor of electricity.

7 (a) Ethanol can be produced by the fermentation of glucose solution.

Which of these shows the word equation for the fermentation of glucose solution?

(1)

☒ **A** glucose → ethanol + water

☒ **B** glucose → ethanol + carbon dioxide

☒ **C** glucose → ethanol + hydrogen

☒ **D** glucose → ethanol + water + carbon dioxide

(b) The names and formulae of the first four alcohols in the homologous series of alcohols are given in Figure 12.

name of alcohol	formula
methanol	CH_3OH
ethanol	C_2H_5OH
propanol	C_3H_7OH
butanol	C_4H_9OH

Figure 12

(i) Pentanol is the next member of this series.
A molecule of pentanol contains five carbon atoms.

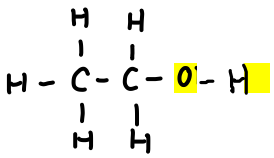
Suggest the formula of a molecule of pentanol.

(1)

$C_5H_{11}OH$

(ii) Draw the structure of a molecule of ethanol.
Show all bonds.

(2)



(c) Ethanol is present in alcoholic drinks, such as wine.

When a bottle of wine is left open some of the ethanol reacts with the oxygen in the air to form ethanoic acid, CH_3COOH, and water.

(i) Complete the equation for this reaction.

(2)

CH_3CH_2OH + O_2 → CH_3COOH + H_2O

*(d) Polymers have many uses.
However, the disposal of polymers after use can be a problem.
The uses of polymers are related to their properties.

Some uses of three common polymers are given in Figure 13.

polymer	uses
poly(ethene)	plastic bags, plastic bottles
poly(chloroethene) (PVC)	window frames, water pipes, insulation for electrical wires
poly(tetrafluoroethene) (PTFE, Teflon™)	coating for frying pans, stain-proofing for clothing

Figure 13

Discuss the reasons for using these polymers in the ways shown in Figure 13 and the problems in disposing of these polymers.

(6)

Poly(ethene) is flexible and cheap. It can also be made into thin films so it can be used to make plastic bags. PVC is tough and can be made hard so it can be used to make window frames. It can be made flexible so it can be used to make water pipes and insulation for electrical wires, as it is an insulator of electricity. PTFE is slippery and unreactive so they can be used as coating for frying pans and stain-proofing for clothing.

Polymers are non-biodegradable. They take up spaces in landfill sites.

Polymers can also be incinerated. Harmful gases and carbon dioxide, which is a greenhouse gas, are released during combustion.

10 Figure 16 shows the structure of a molecule of dichloroethene.

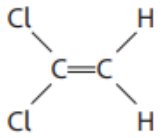


Figure 16

(a) (i) Describe how dichloroethene monomers form a polymer.

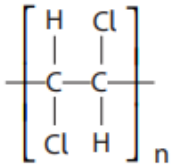
(2)

Dichloroethene monomers form a polymer through addition reaction. The double bond breaks and the carbon atoms form single bonds with neighbouring molecules on the carbon atoms.

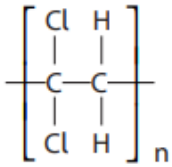
(ii) Which of these represents the structure of the polymer formed from the monomer in Figure 16?

(1)

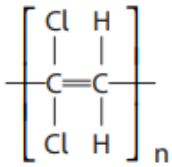
☒ **A**



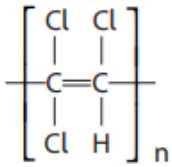
☒ **B**



☒ **C**



☒ **D**



(iii) Separate samples of dichloroethene and poly(dichloroethene) are shaken with a few drops of bromine water.

What would be **seen**?

(1)

☒ **A** both mixtures remain orange

☒ **B** only the dichloroethene and bromine water goes colourless

☒ **C** only the poly(dichloroethene) and bromine water goes colourless

☒ **D** both mixtures go colourless

(b) Dichloroethene is produced from ethene and chlorine.

In the overall reaction, ethene reacts with chlorine and forms dichloroethene and hydrogen chloride.

Complete the balanced equation for the overall reaction.

(2)

$$C_2H_4 + 2Cl_2 \rightarrow C_2H_2Cl_2 + 2HCl$$

(c) Poly(dichloroethene) was used to wrap food to keep it fresh.

Explain **one** property that a plastic food wrapping must have.

(2)

Flexible. Plastic food wrapping must be able to be easily shaped to wrap around the food.

(d) An industrial process uses 500 tonnes of dichloroethene.
In the process only 96.5% of the dichloroethene molecules react.

Calculate the mass of dichloroethene that has **not** reacted.

Give your answer to two significant figures.

(3)

$\frac{100-96.5}{100} \times 500 = 17.5$

$\simeq 18$

mass = 18 tonnes