

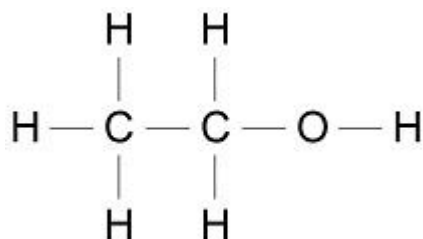
C10 Organic Reactions Homework task 2

Q1.

This question is about ethanol and ethanoic acid.

Ethanol is an alcohol.

(a) The diagram below shows the displayed structural formula of ethanol.



Draw a circle on the diagram above around the alcohol functional group.

(1)

(b) An ethanol molecule contains atoms of three different elements.

Complete the table below to show:

- the name of each element
- the symbol for each element
- the number of atoms of each element in one molecule of ethanol.

Use the diagram above.

Name of element	Symbol for element	Number of atoms in one molecule of ethanol
Carbon	C	
Hydrogen		6
	O	1

(3)

(c) Ethanol removes grass stains from clothes.

What type of substance is ethanol when used to remove grass stains?

Tick (✓) **one** box.

A solute

A solution

A solvent

Wine contains ethanol.

Wine is produced from grape juice by fermentation.

(1)

(d) Complete the sentence.

Grape juice can be fermented to produce wine because

grape juice contains _____.

(1)

(e) What is added to grape juice to cause fermentation?

(1)

(f) Ethanol reacts with ethanoic acid to produce an ester.

What is the name of the ester produced when ethanol reacts with ethanoic acid?

Tick (✓) **one** box.

Ethane

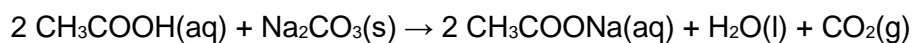
Ethene

Ethyl ethanoate

(1)

- (g) Ethanoic acid reacts with sodium carbonate.

The equation for the reaction is:



What is the name of the liquid produced by this reaction?

(1)

- (h) Vinegar is a solution that contains ethanoic acid.

400 cm³ of vinegar contains 20 g of ethanoic acid.

Calculate the mass of ethanoic acid in 1.0 dm³ of vinegar.

Mass = _____g

(3)

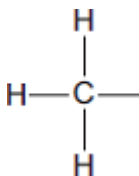
(Total 12 marks)

Q2.

This question is about organic compounds.

- (a) Wine contains ethanol (CH₃CH₂OH).

- (i) Complete the displayed structure of ethanol.



(1)

- (ii) Wine left in a glass for several days turns sour.
The sour taste is caused by ethanoic acid.



Complete the sentences.

The ethanoic acid is produced from a reaction between ethanol
and _____ .

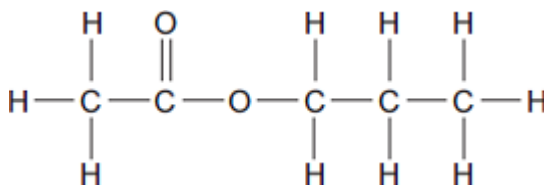
This type of reaction is _____ .

(2)

- (b) Propyl ethanoate, a fragrance, can be produced by reacting ethanoic acid with an alcohol.

Propyl ethanoate is a member of a series of organic compounds. The members of the series all have the same functional group.

The displayed structure of propyl ethanoate is:



- (i) Draw a ring around the functional group for this series on the displayed structure of propyl ethanoate.

(1)

- (ii) Name the series of organic compounds with this functional group.

(1)

- (iii) The alcohol used to make propyl ethanoate has the formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

Name this alcohol.

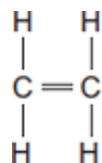
(1)

(Total 6 marks)

HIGHER TIER QUESTIONS

Q3.

A molecule of ethene (C_2H_4) is represented as:



- (a) A sample of ethene is shaken with bromine water.

Complete the sentence.

The bromine water turns from orange to _____ . (1)

- (b) Most ethene is produced by the process of cracking.

- (i) Complete the sentence.

Cracking is a type of thermal _____ . (1)

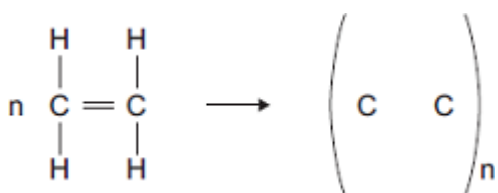
- (ii) Decane ($C_{10}H_{22}$) can be cracked to produce ethene (C_2H_4) and **one** other product.

Complete the equation to show the formula of the other product.

$C_{10}H_{22} \longrightarrow C_2H_4 + \underline{\hspace{2cm}}$ (1)

- (c) Many molecules of ethene join together to produce poly(ethene).

- (i) Complete the structure of the polymer in the equation.



(2)

- (ii) Some carrier bags are made from poly(ethene). Some carrier bags are made from cornstarch.

Suggest **two** benefits of using cornstarch instead of poly(ethene) to make carrier bags.

(2)
(Total 7 marks)

Q4.

There has been research into fuels for car engines.

Fuel	Content	Melting point in °C	Flashpoint in °C	Energy released in MJ per litre
Ethanol	C ₂ H ₅ OH	-114	+14	21.2
Diesel	hydrocarbons	About -24	+64	38.6
Petrol	hydrocarbons	About -57	-45	34.8
Rapeseed oil	fats	About +5	+130	32.8

The flashpoint is the lowest temperature a fuel vapour ignites in air.

- (a) The melting point of ethanol is precise but the other melting points are approximate. Suggest why.

(2)

(b) Ethanol is produced by fermentation of sugar cane. Rapeseed oil is produced by pressing rapeseeds. Waste plant material from both processes is used to feed animals.

(i) Describe how the process of fermentation is done.

(2)

(ii) Carbon neutral fuels do **not** increase the amount of carbon dioxide in the atmosphere.

Suggest why using a biofuel, such as ethanol or rapeseed oil, is thought to be carbon neutral.

(2)

(c) When any fuel from the table is used in a car engine, the exhaust gases contain nitrogen oxides.

Explain why.

(2)

(d) Evaluate replacing petrol with ethanol as a fuel for cars.

To gain full marks you should give a justified conclusion.

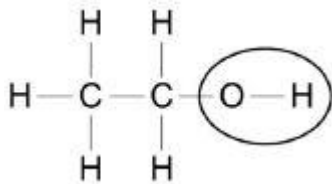
Use the information from the table and your knowledge to answer this question.

(4)
(Total 12 marks)

Mark schemes

Q1.

(a)



1

(b)

Name of element	Symbol for element	Number of atoms in one molecule of ethanol
carbon	C	2
hydrogen	H	6
oxygen	O	1

ignore O2

1
1
1

(c) a solvent

1

(d) sugar

*allow named sugar
allow saccharide*

1

(e) yeast

1

(f) ethyl ethanoate

1

(g) water

ignore H₂O

1

(h) $400 \text{ cm}^3 = 0.40 \text{ dm}^3$

1

$$\frac{1.00}{0.40} \times 20$$

allow correct use of incorrectly converted or unconverted volume

1

= 50 (g)

1

alternative approach:

1.0 dm³ = 1000 cm³ (1)

$\frac{1000}{400} \times 20$ (1)

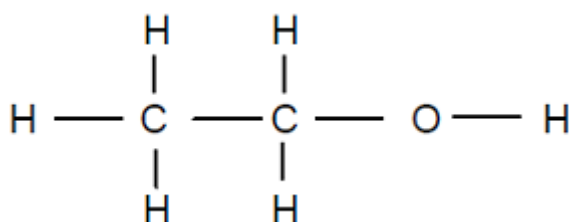
allow correct use of incorrectly converted or unconverted volume

= 50 (g) (1)

[12]

Q2.

(a) (i)



allow other arrangements provided connectivity is correct

allow — OH

1

(ii) oxygen

accept O₂

allow O

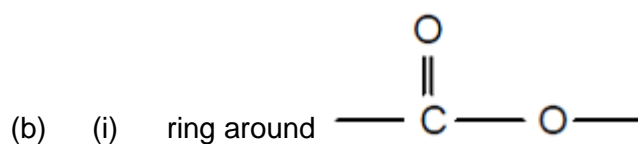
1

oxidation

allow oxidisation / oxidising / oxidised

allow redox

1



1

(ii) ester(s)

*do **not** allow ether(s)*

1

(iii) propanol

propanol accept propan-1-ol

allow propyl alcohol

1

[6]

Q3.

- (a) colourless
ignore clear 1
- (b) (i) decomposition 1
- (ii) C_8H_{18} 1
- (c) (i)
- $$\left(\begin{array}{cc} H & H \\ | & | \\ -C & -C- \\ | & | \\ H & H \end{array} \right)_n$$
- two single trailing bonds extending from the carbons (through the brackets) 1 mark*
five single bonds (1 C–C bond and 4 C–H bonds) 1 mark 2
- (ii) any **two** from:
- (polymers made from) cornstarch are biodegradable
 - less space needed in landfill sites
 - polymers from cornstarch come from a renewable source.
- allow converse for poly(ethene)* 2

[7]

Q4.

- (a) ethanol is made up of only one type of molecule **or** ethanol is a compound
allow ethanol is pure 1
- diesel / petrol / rapeseed oil are mixtures
accept composition of diesel / petrol / rapeseed oil varies / changes
allow different hydrocarbons have different melting points
ignore diesel, petrol and rapeseed oil are impure 1
- (b) (i) sugar is mixed with / dissolved in water
accept sugar cane for sugar 1
- yeast (is added)
allow enzymes are added
if no other mark awarded, allow correct word or chemical equation for 1 mark 1
- (ii) (growing sugar cane / rapeseed) plants absorbs carbon dioxide
accept carbon for carbon dioxide

accept carbon dioxide is used for photosynthesis

1

which is released (when the biofuel burns)

*do **not** accept no carbon dioxide is released (when biofuels burn)*

1

(c) nitrogen / N₂ **and** oxygen / O₂ (in the air)

*do **not** accept fuels contain nitrogen*

1

react in the hot engine / at high temperature

1

(d) any **three** from:

ignore references to melting point

3

• ethanol needs a higher temperature to burn than petrol **or** ethanol has a higher flashpoint than petrol

• ethanol releases less energy (per litre) than petrol

• sugar is renewable **or** crude oil is non-renewable / will run out

• sugar cane growth is unreliable / slow **or** crude oil is a reliable supply
*allow ethanol is not readily available **or** petrol is readily available*

• ethanol is made by a batch / slow process **or** petrol is made by a continuous / fast process

• ethanol is carbon neutral **or** petrol contains 'locked up' carbon dioxide

• sugar / sugar cane should be used for food not for fuels
accept idea of food shortages

a justified conclusion that adds value

*accept one **additional** point from the list above as long as one comparison of replacing petrol with ethanol is made*

1

[12]