

- M1.** (a) (i)  $C_7H_{16}$   
*mark answer line first*  
*answer may be given in the table* 1
- (ii)  $C_nH_{2n+2}$  1
- (b) (i) carbon monoxide  
*do not accept carbon oxide*  
*do not accept water*  
*ignore CO* 1
- (ii) because of partial / incomplete combustion (in reaction 2) **or** complete combustion (in reaction 1)  
*allow because there is less / insufficient oxygen (in reaction 2) or sufficient oxygen (in reaction 1) allow different amounts of oxygen used (in the reactions) or 19O<sub>2</sub> (in reaction 1) and 13O<sub>2</sub> (in reaction 2)*  
*ignore air* 1
- (c) (i) 15 (%)  
*ignore units* 1
- (ii) water (vapour)/steam  
*allow H<sub>2</sub>O / OH<sub>2</sub> / hydrogen oxide* 1
- (iii) sulfur in petrol / crude oil (reacts with oxygen)  
*it = sulfur dioxide* 1

(ii) because nitrogen **and** oxygen (are in the air and) react  
*allow nitrogen **and** oxygen burn*  
*accept nitrogen + oxygen → nitrogen oxide **or** symbol equation*  
*ignore air*

1

at high temperature (inside a petrol engine)  
*allow heat / hot (engine)*

1

(d) because carbon dioxide / it causes global warming **or**  
*allow because carbon dioxide / it causes greenhouse effect /*  
*climate change*

1

because carbon dioxide / it has an impact on oceans

because this carbon dioxide / carbon / it was 'locked up' (in fossil fuels) **or**

because the percentage/amount of carbon dioxide / it in the atmosphere is increasing

1

[11]

**M2.** (a) (i) *use of carbon throughout = max 1*

burning biodiesel releases CO<sub>2</sub>

*ignore burning trees*

**1**

CO<sub>2</sub> is absorbed / used by the crops/plants (used to produce the biodiesel)

*allow CO<sub>2</sub> absorbed / used by trees*

**1**

(ii) *allow use of carbon for carbon dioxide throughout*

increases CO<sub>2</sub> / greenhouse effect

*accept causes global warming*

**OR**

*allow causes climate change*

less CO<sub>2</sub> is absorbed (from atmosphere)

*ignore other correct effects*

**1**

because burning trees releases CO<sub>2</sub>

*accept fewer trees to absorb CO<sub>2</sub>*

*or crops / plants do not absorb as much CO<sub>2</sub> as trees*

**OR**

because there is less photosynthesis

*ignore habitats / biodiversity*

*if no other mark awarded global dimming because of smoke /*

*particles gains 1 mark*

1

(b) any **one** from:

*ignore carbon neutral / cost / less harmful / environmentally friendly*

- crude oil / fossil fuel is running out / non-renewable

*allow biodiesel is renewable / sustainable*

- demand for fuels / energy is increasing

*ignore demand for biodiesel is increasing*

- new legislation / protocols

1

(c) (i) uses crops / land that could be used for food

*allow destroys habitats or reduces biodiversity*

*ignore cost*

1

(ii) increases the cost of food / land

*ignore cost of machinery / process*

*ignore cheaper to produce biodiesel*

1

[7]

**M3.** (a) carbon dioxide decreased (by plants / trees)

*allow plants / trees absorbed carbon dioxide*

**1**

oxygen increased (by plants / trees)

*allow plants / trees released oxygen*

*if neither of these marks awarded*

*allow plants / trees*

*photosynthesise for 1 mark*

**1**

because coal 'locks up' / traps / stores carbon dioxide / carbon

*allow trees 'locked up' carbon dioxide / carbon*

**1**

(b) carbon / C

hydrogen / H

sulfur / S

*all 3 correct 2 marks*

*1 or 2 correct 1 mark*

*allow H2*

*ignore oxygen*

**2**

(c) (i) 2 2

*balancing must be correct*

*do **not** accept changed formulae*

1

(ii) increases atmospheric pollution

carbon dioxide / CO<sub>2</sub> released

1

from the (thermal) decomposition of calcium carbonate **or**

*accept causes global warming **or** CO<sub>2</sub> is a greenhouse gas*

description of this decomposition **or** equation

*ignore sulfur dioxide and effects in this part*

1

decreases atmospheric pollution

sulfur dioxide / SO<sub>2</sub> is removed

*accept less acid rain produced*

1

by reaction with calcium oxide **or** calcium carbonate

*accept neutralisation **or** forms calcium sulfate*

**1**

**[10]**

**M4.** (a) (i) a reasonable attempt at a smooth curve

*allow a curve which is close to but does not necessarily touch all points*

**1**

(ii) any **two** from:

*allow thicker / thinner / runny for viscous*

- biodiesel is more viscous than petroleum diesel at all / lower temperatures
- biodiesel – as the temperature increases the viscosity decreases or vice versa
- petroleum diesel – the viscosity does not change

*if no other mark awarded*

*allow 1 mark for any correct conclusion based on time or rate of flow*

**2**

(iii) does not flow as easily (through pipes / engine)

*allow could form a solid / block pipes / engine at low temperatures*

**or**

needs a high temperature to flow

*allow more difficult to vaporise / ignite*

*ignore burning*

*ignore references to viscosity*

**1**



(b) (i) global dimming

*allow correct description*

**1**

(ii) 56 (%)

**1**

(iii) (increases) acid rain

**1**

because there is more nitrogen oxide(s)

*ignore sulfur dioxide*

*if no other mark awarded*

*allow 1 mark for nitrogen oxide(s) given*

**1**

(iv) *answer yes or no does not gain credit because the marks are for  
an explanation*

*ignore references to petroleum diesel*

*allow carbon for carbon dioxide*

no

because carbon dioxide (26%) is released / produced

**1**

this will not all be absorbed by photosynthesis / growing plants for biodiesel

*accept growing plants / farming uses machinery / fossil fuels releases  
carbon dioxide*

**OR**

yes

because although carbon dioxide (26%) is released / produced (1)

this was absorbed by photosynthesis / growing plants (for biodiesel) (1)

*allow this will be absorbed by photosynthesis / growing plants for  
biodiesel*

**1**

**[10]**

**M5.** (a) complete diagram with 2 carbon atoms and 5 hydrogen atoms each C–C and each C–H linked by a single line (bond)

1

(b) (i) the greater the number of (carbon) atoms (in an alkane molecule) the greater its boiling point **or** vice versa

*allow as the (carbon) chain gets longer the boiling point increases*

*ignore melting points*

*do **not** accept reference to greater number of molecules*

1

(ii) *they = hydrocarbons from the graph*

*it = C<sub>30</sub>H<sub>62</sub>*

any **two** from:

- low boiling point / volatile  
*accept they are gases or liquids*
- low viscosity
- high flammability  
*accept easier to burn / ignite*
- small molecules  
*accept short chains*  
*ignore number of carbon atoms*
- burn completely

*ignore speed of burning*

**2**

(c) (i) 16 (CO<sub>2</sub>) + 18 (H<sub>2</sub>O)

**1**

(ii) (carbon dioxide in the Earth's early) atmosphere

*accept from volcanoes (millions of years ago)*

*or from dead plants / animals*

*allow dead sea creatures*

*ignore shells*

**1**

(iii) increase in burning / use of fossil fuels

**1**

locked up carbon (carbon dioxide) is released

*allow carbon / carbon dioxide from millions of years ago is released*

*accept extra carbon dioxide is not 'absorbed' (by the carbon cycle)*

**1**

**[8]**

**M6.** (a) (thought to cause) global warming / green house (effect) / climate change

*ignore other consequences of global warming*

*do **not** accept acid rain / ozone layer / global dimming*

**1**

(b) any **three** from:

- replant trees / renewable / sustainable

*ignore reusable*

- carbon (dioxide) used by trees / photosynthesis

*accept trees absorb carbon (dioxide) as they grow*

*ignore respiration*

- it is a (continuous / carbon) cycle

*accept burning wood is carbon neutral*

**or**

carbon (dioxide) goes back into the air

*for the **second** and **third** bullet points: accept trees use carbon dioxide*

*which is released when (trees / wood are / is) burnt for **2** marks*

- no new carbon (dioxide) is produced

**or**

no locked up carbon (dioxide) is released

**or**

the carbon (dioxide) was absorbed millions of years ago

**3**

**[4]**

**M7.** (a) (i) straight line through the 'points' and extended to C8H18

*do not accept multiple lines*

**1**

(ii) 5500

*range 5400 to 5600*

*accept ecf from their graph*

**1**

(iii) it is a straight line graph

*allow directly proportional*

*accept constant difference between (energy) values*

*accept C5H12 close to values on the graph*

*or C5H12 comes in middle of the graph*

*ignore 'fits the pattern' unqualified*

*ignore 'line of best fit'*

*ignore 'positive correlation'*

**1**

(iv) expected ranges for working are:

*accept correct numerical answer as evidence of working*

$$(5400 \text{ to } 5600) - (2800 \text{ to } 2900) = (2500 \text{ to } 2800)$$

**or**

their value from (a)(ii) – a value from 2800 to 2900

**or**

(5400 to 5600) / their (a)(ii) divided by 2

**or**

a value from 2800 to 2900 - 2

**1**

no / not quite / almost / yes

*this mark is only awarded on evidence from their correct working*

**1**

(b) (i) incorrect / no **or** partially correct

*ignore references to hydrogen*

**1**

bio-ethanol produces least energy

*mark independently*

**or**

bio-ethanol produces 29 kJ

**1**

(ii) *ignore incorrect / correct*

any **two** from:

- hydrogen produces only H<sub>2</sub>O  
*accept hydrogen does not produce harmful gases / CO<sub>2</sub> / SO<sub>2</sub>*
- coal produces SO<sub>2</sub>  
*allow coal causes acid rain / respiratory problems*
- coal produces smoke  
*allow coal causes global dimming*
- both renewable and non-renewable fuels produce CO<sub>2</sub>  
*accept bio-ethanol and natural gas / coal produce CO<sub>2</sub> / global warming*
- (both) the non-renewable fuels produce CO<sub>2</sub>  
*accept coal and natural gas produce CO<sub>2</sub> / global warming*
- (both) renewable fuels produce no smoke  
*accept hydrogen and bio-ethanol do not produce smoke / global dimming*
- (both) renewable fuels produce no SO<sub>2</sub>  
*accept hydrogen and bio-ethanol do not produce SO<sub>2</sub> / acid rain*

2

[9]