Mark schemes

1

(a) any **one** from:

- gasoline / petrol / it contains short(er) chains / hydrocarbons **or** small(er) molecules **or** contains few(er) carbons

  *accept fuel oil contains long(er) chain length / large(r) molecules **or** contains many carbons*

  ignore particles

- gasoline / petrol / it has weak(er) / small(er) intermolecular forces

  accept fuel oil has strong(er) / great(er) intermolecular forces

1

(b) only accept figures if used in a comparative statement

any **two** from:

- gasoline / petrol / it is in high demand

  accept fuel oil is in low demand

- gasoline / petrol / it is in short supply

  accept fuel oil is plentiful

  *accept answers such as 'gasoline / petrol / its supply is less than demand for **2** marks*

  ***or** gasoline / petrol / its percentage in crude oil is less than demand for **2** marks*

- (high) tax / duty

- <u>cracking</u> costs in terms of money / energy

  accept <u>cracking</u> expensive

2

(c) any **two** from:

ignore particles

- (fuel oil / it) heated / vaporised

- with catalyst

  accept a named catalyst

  *if first two bullet points are not awarded 'cracking' gains **1** mark*

- (to give / form / produce) short(er) chains / hydrocarbons **or** small(er) molecules **or** contains few(er) carbons

  *if wrong process named max **1** mark*

2

[5]

2 (a) (i) poly(ethene)

accept polythene

1

(ii) cracking

1

(iii) hydrogen

1

(b) (i) bar labelled 9

1

bar drawn to correct height

1

(ii) (boiling point) increases

1

(iii) heat / evaporate (the crude oil)

accept separate by boiling point

1

cool / condense (hydrocarbons at different temperatures)

accept smaller molecules go to top / larger molecules stay at bottom

*accept fractional distillation for two marks **or** distillation / fractionation for **one** mark*

1

(c) **yes**

any **two** from:

- because plastic does not biodegrade **or** running out of space for landfills **or** land cannot be used for a long time
- it provides heat energy
- which can be used to generate electricity / heat homes or greenhouses
- any other advantage of burning
- any other disadvantage of landfill

or

no

- burning plastic produces carbon dioxide / carbon emissions / toxic gases
  accept landfill does not produce carbon dioxide / carbon emissions
- causes global warming / climate change / increase greenhouse effect / global dimming / acid rain
- any other disadvantage of burning
- any other advantage of landfill

2

[10]

3 (a) (i) heat / evaporate the crude oil / change to gas or vapour
*do **not** accept heat with catalyst*

1

cool / condense (hydrocarbons)
allow small molecules at top and / or large molecules at bottom

1

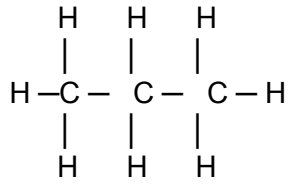
at different temperatures / boiling points
if the answer describes cracking ' no marks

1

(ii) C_4H_{10}

1

(b)



1

(c) (i) C_5 to C_8 fraction are fuels **or** easier to burn or petrol (fraction)

accept C_{21} to C_{24} fraction not useful as fuels

***do not** accept produce more energy*

1

(ii) C_2H_4

*do **not** accept C_4H_8*

1

(iii) any **three** from:

- use different / lighter crude oils
- develop markets for low demand fractions
- develop new techniques / equipment to use low demand fractions as fuels
- cracking
- convert low demand fractions to high demand fractions or bigger molecules to smaller molecules
- develop alternative / bio fuels

*do **not** accept price*

3

[10]

4

(a) hydrogen

ignore formulae

1

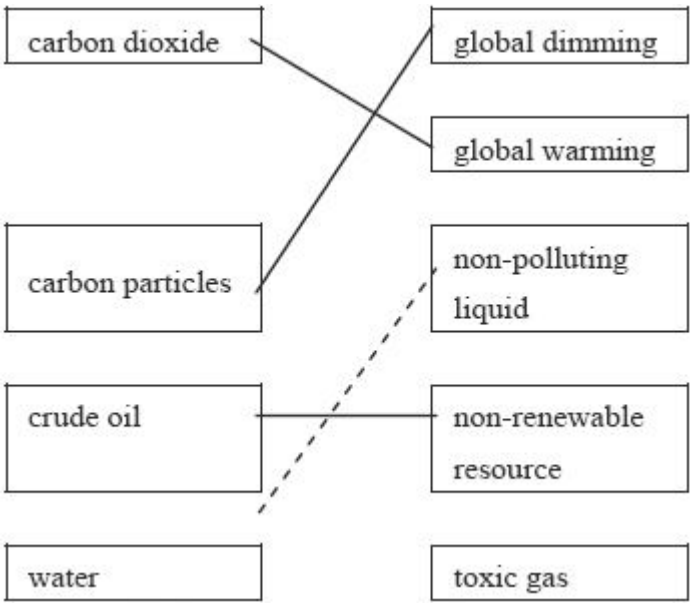
(b) any **two** from:

- different sized molecules / more or less (carbon) atoms (in molecules)

  ignore different densities
- fuels have <u>different</u> boiling points
- fuels condense at <u>different</u> temperatures

2

(c)



*all three correct = **3** marks*
*two correct = **2** marks*
*one correct = **1** mark*

3

[6]

5 (a) (i) by (fractional) distillation

*accept a description of the distillation process (heat and how separation works) eg heat **and** condense*
accept boil / vapourise etc for heat

or

fractionation

1

(ii) CO_2

note the order of these products must be correct

1

H_2O

*wrong way round = **1** mark*

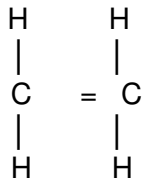
1

(b) (i) (hexane) has been broken down (into smaller hydrocarbons / molecules)

1

accept (thermal) decomposition / cracked / split / broken up owtte

(ii)



accept $CH_2 = CH_2$

1

(iii) water / hydrogen oxide / steam

accept H_2O

1

(c) candidates must include both sugar cane and crude oil in their evaluation **and** both an advantage and a disadvantage to gain full marks.
if they do not then the maximum mark is three

any **four** from:

<u>advantages of using sugar</u>

- country has no wealth to buy (large quantities of) crude oil
  not 'expensive' alone
- country has limited technological development

  or

  underdeveloped / third world country
- able / suitable climate to grow sugar cane
- enough land to grow sugar cane / land cannot be used to grow food / deforestation
- sugar is a renewable source

  or

  crude oil is a non-renewable resource / finite resource / limited resources
- CO_2 / carbon neutral

<u>advantages of using alkanes:</u>

- economic costs are low
- continuous process
- country has large oil resources
- country has oil refineries / cracking plants
- very pure product
- faster process

4

[10]

6 (a) hydrocarbons

1

(b) evaporation

1

condensation

1

distillation

allow fractional distillation

1

(c) lower **and** more

1

[5]

7 (a) (i) e.g. moles NaOH = moles of acid

or formula:

$0.2 \times \frac{45}{1000} = 0.009$

$15M_1 = 0.2 \times 45$

1

rounding to 0.01 loses mark

$= 0.009 \times \frac{1000}{15} = 0.6(M)$

$M_1 = 0.6(M)$

ecf for arithmetical error

*correct answer **2** marks*

1

(ii) 36

ecf – (a)(i) × 60
*correct answer **2** marks*
*0.6 × 60 gets **1** mark*
relative formula mass of ethanoic acid
*= 60 for **1** mark*
0.6 × incorrect molar mass gains second mark only

2

(b) (i) A = hydrogen / H_2

1

B = sodium hydroxide / NaOH **or**
sodium oxide / Na_2O

1

(iii) C = ethyl ethanoate (acetate) /
$CH_3COOC_2H_5$ / $CH_3CO_2C_2H_5$

1

(iv) D = (concentrated) sulphuric acid /
H_2SO_4

*do **not** accept dilute sulphuric acid*

1

E = sodium ethanoate (acetate) / CH_3COONa / CH_3CO_2Na

1

[9]

8 (a) hydrogen

*accept correct symbols but **not** H_2*

1

carbon

1

(b) (i) water

accept H_2O

1

(ii) limewater / calcium hydroxide

accept $Ca(OH)_2$

1

(iii) milky / cloudy / chalky / white

1

(c) (i) remains almost the same / increases then decreases slightly from 1000 to 1800

1

increases / rises after 1800

1

rapidly (owtte)

1

(ii) increased burning of hydrocarbon / (fossil) fuels, etc. **or** increased use of fuels

accept deforestation
accept (more) cars / lorries / planes etc.
accept power stations
*do **not** accept just 'factories'*

1

[9]

9

(a) catalyst **or** speeds up the reaction (owtte)

*accept lowers activation energy **not** just helps reaction to take place*
ignore increased surface area

1

(b) C_8H_{18}

allow $H_{18}C_8$
must be upper case
*do **not** accept powers*

1

(c) B
because it is a gas **or** because it has small molecules **or** because <u>they</u> are small

*position **and** reason for mark*
*allow it has a lower / <u>very</u> low boiling point than **A***
ignore references to solubility
accept does not condense
*do **not** accept light molecules **or** bubbles into B*
*do **not** accept <u>it</u> is small*

1

(d) breakdown of a substance (owtte)

*do **not** accept decompose unqualified*

1

by the action of heat (owtte)

1

(e) **Quality of written communication**

if the written communication makes sense and it is in context then award Q mark

Q ✓ Q ✗

1

large to small molecules **or** scientific word that implies smaller,
e.g. alkene / ethane / petrol

any name or formula of alkane / alkene smaller than decane

1

either advantages of smaller molecules **or** disadvantages of larger molecules
e.g. hydrocarbons with large molecules are limited in their usefulness

or *converse for smaller molecules*

1

large hydrocarbon molecules do not ignite easily / do not flow easily /
are not very volatile

or *converse for smaller molecules*

more large hydrocarbon molecules are produced than are needed

or *converse for smaller molecules*

smaller molecules are useful as fuels

alkenes / products can be used to make polymers

(f) (fractional) distillation

accept fractionation
accept good description
*do **not** accept just diagram*

1

[9]

10 **Quality of written communication:**

*for correct sequencing or linking of **two** ideas or **two** points*
annotate Q ✓ or Q ✗

1

any **three** from:

ignore superfluous statements

- **B** is least energy efficient in terms of cost (kJ per p), so **A** = **C** = **D** in terms of cost **or B** is the most expensive in terms of energy efficiency
owtte

  *accept **B** is poor value for money / **B** is most expensive*
  one is insufficient for mark

- **D** is 1st, since gives only water as product **or** gives no harmful products / gases **or** there are no pollutants
owtte

- **A** is 2nd best, since produces CO_2 owtte

- **C** is 3rd, since gives SO_2 owtte

  *if no other marks, then **D A C B** – based on energy per kJ per 100g only = **1** mark and Q mark if 2 ideas are linked*

3

[4]

11 (a) hydrocarbon is a compound

***not** mixture **not** substance*

1

containing carbon and hydrogen

accept of the elements carbon and hydrogen

accept of carbon and hydrogen

contains hydrogen and carbon only (2)

1

(b) (i) any order

carbon dioxide

accept CO_2

***exact** formulae*

2

water 1

accept H_2O

***not** carbon in one box and dioxide in second box (0)*

ignore any attempt to 'balance' the equation

(ii) it is poisonous

accept toxic

can kill you

accept any reasonable description

of its effect on red blood cells ***or*** *on*

haemoglobin in terms of reducing

oxygen transport

not *can explode, harmful,*

dangerous, flammable

1

[5]

12 (a) (i) by heating

pressure is neutral

using a catalyst/pot/ceramic/porcelain/aluminium oxide

1

(ii) use bromine water/(alkaline) permanganate

accept bromine

1

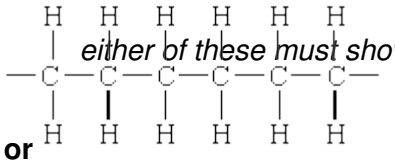
alkene makes bromine go colourless or lose its colour

accept alkane does not change the red/orange colour of bromine

not *change colour/goes clear*

1

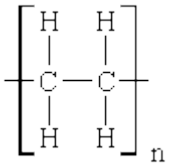
(b) (i)



either of these must show bonds at end

1

or



not *H on ends*

allow 3 instead of n ***not*** *any other number*

(ii) poly(ethene) – brackets not essential

accept polythene

1

(iii) **large amount** of waste polymer/poly(ethene)/polythene/litter

*accept large amount of crude oil **or** finite resource used*

1

it is not biodegradable

accept it does not

decompose/decay/break down

it causes pollution/it creates toxic

fumes when burnt are neutral

***not** it is not recyclable*

2

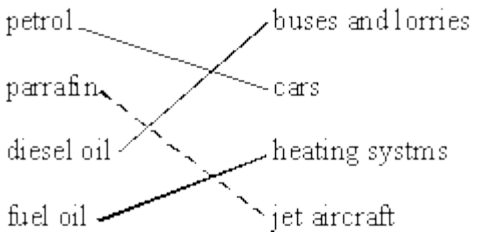
[8]

13

(a) all **three** lines correct **two** marks

one or two lines correct **one** mark

***two** ticks only*



accept diesel oil joined to cars

1

(b) (i) because it has a different boiling point

accept because of its boiling point

***or** it has a boiling point of 40 °C*

1

(ii) CO_2 **or** carbon dioxide

1

H_2O **or** water

accept steam

1

[5]

14

(a) catalyst

1

(b) (i) made up of **only** carbon and hydrogen

1

(ii) C_8H_{18}

1

(c) (i) ethene

1

(ii) polymerisation

1

[5]

15 (a) C_3H_8

1

(b) (i) increases / gets larger

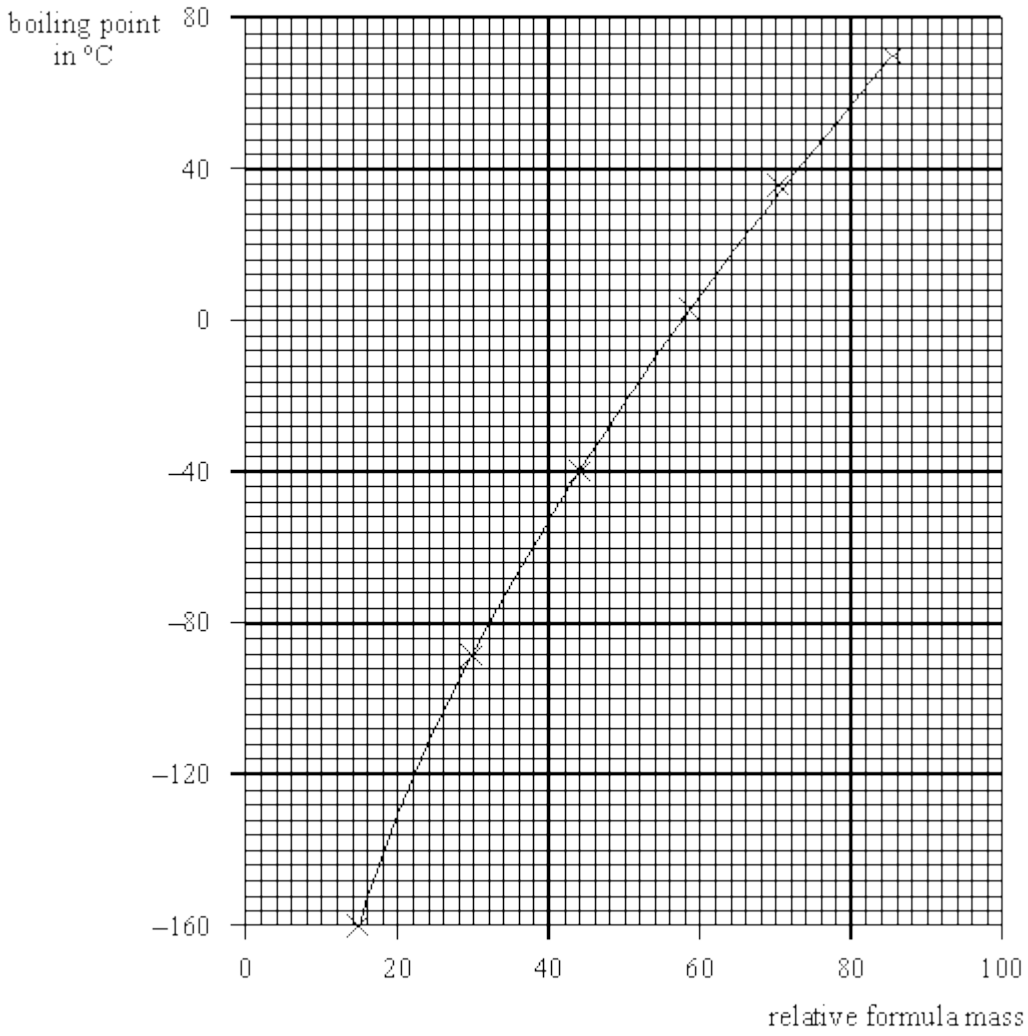
1

(ii) all 5 points plotted correctly

deduct 1 mark for each incorrectly plotted point
*but **ignore** –90, 30*
allow error of one square in any direction

2

smooth line graph



1

(iii) boiling point estimate from their graph

allow ± 2 °C

1

(iv) shown clearly on graph

allow just one construction line drawn

1

(c) C_9H_{18}

1

[8]

16 (a) fractional distillation

1

boiling point or use

1

(b) (i) mixture: compounds **or** elements **or** substances together but not chemically combined

ignore references to separation

1

compound: (different) elements **or** different atoms together and chemically combined

ignore references to separation

1

(ii) element: contains only one type of atom

accept made of atoms which contain the same number of protons

1

compound: contains different types of atom chemically combined

'chemically combined' not needed here if already stated in (b)(i)

1

[6]

17 (a) (i) heat

accept increase temperature ignore pressure

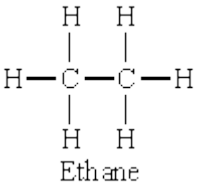
1

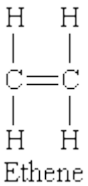
with a catalyst

1

(ii)

1





accept displayed formulae only

1

(iii) O_2

1

$CO_2 + H_2O$

ignore state symbols

1

correct balancing
$2 + 7 \rightarrow 4 + 6$

accept $1 + 3\frac{1}{2} \rightarrow 2 + 3$ *only if reactants and products correct*

1

(b) double bond breaks

1

many (ethene) molecules

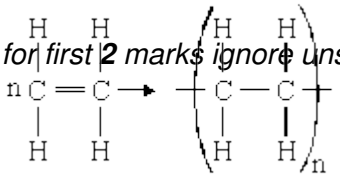
accept many monomers

1

bond together

accept join ***or*** *combine for bond*

accept



for first ***2*** *marks ignore unsaturated becomes saturated*

1

[10]

18 (a) N_2

1

20–21%

accept an answer in this range

1

Ar

1

(b) (i) compound of carbon and hydrogen only

do ***not*** *accept 'mixture'*

1

(ii) Oxygen **or** O_2

1

(iii) exothermic

*accept combustion **or** oxidation*

1

(iv) **increases** greenhouse effect

1

global warming **or** example

1

[8]

19 (a) organic

1

sediment

1

(b) (i) gases

1

(ii) bitumen

1

(c) (i) cracking

accept thermal decomposition

*do **not** accept endothermic*

1

(ii) many **or** short **or** small (ethene) molecules

accept monomer

*accept double bonds open up **or** break*

1

join to make larger molecules

accept polymer

accept polymerisation

*accept short chain to long chain (**or** molecules)*

*do **not** accept unsaturated to saturated*

1

(d) poor ventilation

accept limited air supply

accept insufficient oxygen

1

causes incomplete combustion

accept produces CO

1

(fumes contain) carbon monoxide which dangerous

*toxic is **not** awarded a mark*

*do **not** accept harmful or poisonous*

1

[10]

20 air or oxygen;
oxygen;
heat;
carbon dioxide;
water;
chemical

for 1 mark each

[6]

21 (a) A compound made from carbon and hydrogen (not mixture etc.)

1

(b) C_5H_{12}

1

(e) (i) Break down

by heat

(ii) Speeds up reaction

(iii) C_8H_{16}

each for 1 mark

4

[6]

22 (a) oxygen/O_2

for 1 mark

1

(b) water/H_2O

for 1 mark

1

(c) carbon dioxide/CO_2
(if symbols are used they must be correct)

for 1 mark

1

(d) gives out

for 1 mark

1

heat or energy (2 independent marks)

for 1 mark

1

[5]

23 (a) fume cupboard
plastic gloves (only one tick)

for 1 mark

1

(b) (i) plotting points (allow ± 0.5 units either vertically or horizontally)
(all correct = 2) (3 correct =1)
curve (not joined with straight lines. Must be very close
to all points. One line only) (1 mark)

gains 3 marks

3

(ii) as read from graph (±0.5 units) –
points must be joined

for 1 mark

1

(iii) decreases, gets less, quicker

for 1 mark

1

(c) (i) flows, moves, passes through (not rubbing/moving of
engine parts)

for 1 mark

less etc

for 1 mark

2

(ii) parts rub against each other
increases wear of engine parts
damages the oil
engine seizes
overheating of engine
(not burns or blows up)
(not just 'damage')

any 1 for 1 mark

1

[9]

24 (i) carbon and hydrogen
only **or** compound **of**

for 1 mark each

2

(ii) single bonds only
or no double bonds etc
or contains maximum number of hydrogen atoms

for 1 mark

1

(iii) molecules of similar chain length
similar boiling points
limited range of boiling points etc

any 1 for 1 mark

1

[4]

25 (a) C_2H_4

1

H H H
H C C C H
H H H

Accept even if in wrong columns

1

(c) (i) polythene or poly(ethene)

1

(ii) addition

1

[4]

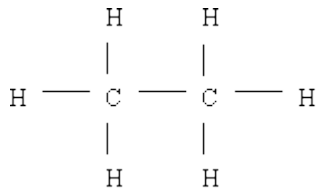
26 (a) the more C atoms the higher the b.pt./temperature
Allow just higher. **Not** answer based on melting point
for 1 mark

1

(b) (fractional) distillation/fractionation
for 1 mark

1

(c)



must include H atoms and lines **not** $CH_3 - CH_3$
for 1 mark

1

[3]

27 (a) $C_{16} H_{34}$
for 1 mark

1

(b) electron
gains 1 mark

but shared electrons
gains 2 marks

2

[3]

28 (a) (fractional) distillation/fractionation
for 1 mark

1

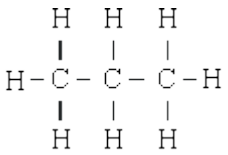
(b) (i) cracking/decomposition
for 1 mark

1

(ii) polymerisation/addition reaction
for 1 mark

1

(c)



(Must have H atoms)

for 1 mark

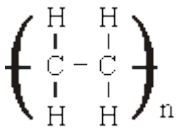
1

(d) contains <u>only/all</u> single bonds
no double bonds
contains maximum number of H atoms
carbon atoms bonded to 4 other atoms (not 4 H atoms)
will not undergo addition reactions

any 1 for 1 mark

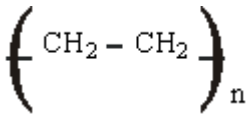
1

(e)



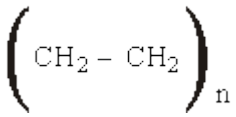
(n must be on (right))

= 2 marks

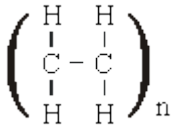


(n on left = 1 mark)

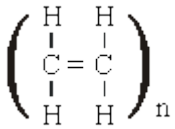
= 2 marks



= 1 mark



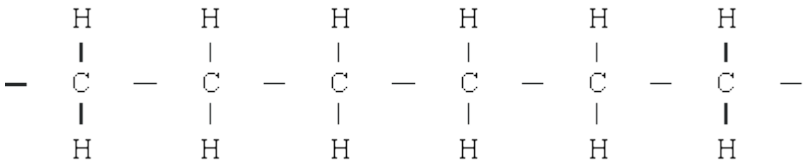
= 1 mark



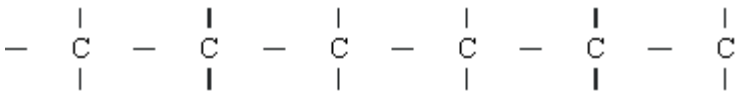
(Double bond loses both marks)

= 0 marks

OR



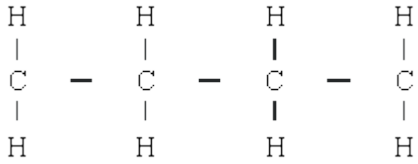
= 2 marks



(for both a minimum of 4 carbon atoms)

= 1 mark

= 2 marks



= 1 mark

= 1 mark

2

[7]

29 (a) hydrocarbons

for 1 mark

1

(b) less carbon atoms / smaller molecule

for 1 mark

1

[2]

30 (a) hydrogen and carbon

for 1 mark

1

(b) (i) the oil is evaporated / boiled / liquid converted to gas / vaporised

oil is condensed/changed back to liquid/cooled below boiling point (not just cooled)

liquids of different boiling points condense at different levels /
fractions with lower boiling points form near the top /
boiling point linked to chain length or Mr

each for 1 mark

3

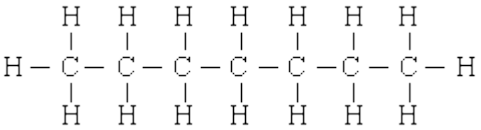
(ii) Assume they mean naphtha unless they say otherwise.
smaller molecules
/contains less atoms
/lower boiling point
/more volatile
/less bonds to break
/lower activation energy

If the answer is given the opposite way around then diesel must be specified.

any one for 1 mark

1

(iii)



correct number of atoms = 1
correct number of bonds (attached to correct atoms) = 1
Accept diagrams which show electrons correctly.
$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$ = 1

for 2 marks

2

[7]

31 (i) C_8H_{18}

for one mark

1

(ii) mixture

for one mark

1

(iii) fractions molecules
atoms
evaporated condensed
in this order for 1 mark each

5

[7]

32 (a) (i) bonds / pair of electrons / shared electrons
for one mark

1

(ii) saturated since it has single bonds / no double bonds / no multiple bonds / maximum number of atoms attached
for one mark

1

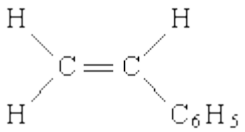
(iii) sensible answer (e.g. it is harmful)
or better solvent could be used on expanded polystyrene or foam
for one mark

1

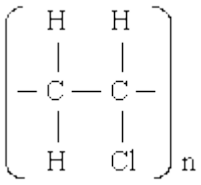
(b) (i) simply writing monomers form / react to form polymers gains no mark
monomers join / bond / combine / link to form polymers = 1 mark
the mark is for the idea of joining
to gain the second mark the idea of the relative size of monomer and polymer is required
small molecules join to form a polymer (2 marks)
many monomers join to form a polymer (2 marks)
monomers join to form a large molecule / long chain (2 marks)
many molecules join together (2 marks)
for 1 mark each

2

(ii) polyethene / poly(ethene) / polythene



don't worry too much about the exact positioning of the C_6H_5 at the end of the bond



placement of linking bonds inside / outside brackets is not important
must have n

for 1 mark each

[8]

33 (a) low

1

hydrogen

1

(b) any **three** from

- flame

  accept it is a blue / yellow colour

- reacts with oxygen

  accept burns in oxygen / bonds broken

- carbon dioxide carbon monoxide forms

  accept CO_2 arco / bonds forming in CO_2/CO and H_2O
  bonds forming 1 mark max

  *accept an oxide of hydrogen **or** H_2O*

- water (vapour) forms

  *accept heat **or** light released / temperature increase / exothermic*

- energy released

3

[5]

34 (a) any **three** from

carbon (atom) spine / chain

accept idea of 'backbone' of carbon (atoms)

surrounded by hydrogen (atoms)

accept idea of only bonded to hydrogen (atoms)

3

single (covalent) bonds between carbon atoms

accept no double bonds

saturated (hydrocarbons)

(general formula) C_nH_{2n+2}

(b) many small molecules/ monomers

*accept many unsaturated molecules **or** alkenes*

1

join together to form a large / long molecule / polymer

1

[5]

35 (a) the higher the boiling point, the greater the number of carbon atoms

1

(b) volatility / viscosity / runnyness / flammability / smokiness / amount of oxygen needed for burning / melting point

*do **not** credit how heavy it is / how it burns*

1

(c) hydrogen and carbon (both)

allow H and C (upper case)

1

[3]

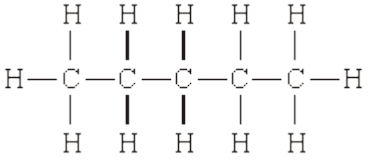
36 (a) **B** because it contains more of the light fraction)

1

Quantitative answer e.g. **B** has 30%,
A has 20% / 10% more / 1.5 times more

1

(b) (i)



1

(ii) heat

1

catalyst

if neither mark gained allow cracking for 1 mark

1

[5]

37 (a) (i) **X** and **Y**

both needed

1

(ii) **Z**

1

(iii) **X**

1

(b) unsaturated / alkenes / those with double (C = C) bonds

1

[4]

38 (a) LHS lithium + water

accept Li and H_2O

accept hydrogen oxide for water

1

RHS hydrogen + lithium hydroxide

accept H_2 and LiOH

ignore attempts at balancing

ignore charges

1

(b) ***Quality of written communication***

One mark for the correct use of any **three** of the terms atom, covalent, bond(ing), saturated, hydrocarbon or alkane

1

any **three** from*:*

one / the carbon (atom)

reject molecules once

four hydrogen (atoms)

shape / properties neutral

CH_4

hydrocarbon

saturated / single bond

covalent bond / shared electrons

alkane

reject ionic bond

3

[6]

39 (a) carbon

1

hydrogen

any order

1

(b) fractional

1

distillation

accept description

- *heat **or** evaporate / boil (1mark)*
- *separated when they condense **or** by boiling points (1 mark)*

1

(c) alkenes

*accept names **or** unsaturated hydrocarbons*

1

[5]

40 (a) any **two** 1 mark each

burning / combustion

fossil fuels **or** (locked up) carbon
accept fuel / named fuel

oxygen used

2

(b) any **three** from

produces (calcium) carbonate

which is insoluble

produces (calcium) hydrogencarbonate

which is soluble

photosynthesis

releases oxygen

3

[5]

41 (a) all plots correct
*3 **or** 2 plots correct gains 1 mark*

2

all sectors correctly labelled

1

(b) (i) (fractional) distillation

1

(ii) gases

1

(iii) bitumen

1

[6]

42 (a) hydrocarbon

1

(b) thermal decomposition / cracking

1

(c) (i) making polymers / poly(e)thene

accept plastic (bags)

1

(ii) fuel

1

[4]

43 (a) (i) fractional distillation

both words required

accept fractionation

1

(ii) any **one** from

ethane

propane

butane

1

(b) (i) carbon dioxide

1

water (vapour)

accept steam

do not credit symbols

1

(ii) carbon monoxide

accept CO

*do not credit soot **or** carbon oxide*

1

[5]

44 (a) Substance Use

A any **pair** from

award one mark for a correct use for an incorrect fuel

methane **or** natural gas **or** refinery gas	fuel
ethane	fuel **or** making ethene for polymerisation
propane	bottled **or** camping gas **or** fuel

accept relevant trade names e.g. Calor Gas

2

butane	*bottled **or** camping gas **or** fuel **or** lighter fuel*

B any **pair** from

petrol **or** gasoline	fuel for cars

accept car engines
do not credit just cars

naptha	petrol **or** chemicals **or** feedstock **or** solvent
paraffin **or** kerosene	heating fuel **or** aviation fuel

*accept jet **or** aircraft fuel*

2

C any **pair** from

naptha	petrol **or** chemicals **or** feedstock **or** solvent

paraffin **or** kerosene	heating fuel **or** aviation fuel
diesel **or** diesel oil **or** (light) gas oil	vehicle fuel **or** heating fuel
(lubricating) oil	lubricating **or** oiling qualified, eg. oiling a gate
fuel oil	industrial **or** heating fuel
heavy gas oil	fuel for stationary **or** slow speed diesel engines

2

(b) CO_2 and H_2O

both required

1

[7]

45 (a) C=C

do not accept C_2H_4

1

four Hs only, two attached to each carbon

credit CH_2CH_2 for two marks

1

(b) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

two correct formulae LHS

1

can be in either order
two correct formulae RHS

1

can be in either order
correctly balanced, consequential
marking allowed for 10 O

1

[5]

46 (a) heat/light

1

(b) any reference to the products being (colourless) gases/smoke

1

[2]

47 hydrogen
carbon

in any order each for 1 mark

[2]

48 carbon;
hydrogen (any order)

each for 1 mark

[2]

49 (a) Compound A has fewer C atoms
or Compound B has fewer H atoms

Compound A has C = C/double bond
or Compound A is unsaturated

each for 1 mark
(accept converse i.e compound B has not ...)

2

(b) Compound A is reactive
or can be used to make many substances
or can be used in polymerisation/making plastics/named plastic
or can be used as a fuel

any one for 1 mark

1

[3]

50 (a) (i) oxygen
air
each for 1 mark
2

(ii) carbon dioxide
for 1 mark
1

(b) 30 seconds ± 5 inclusive
for 1 mark
1

[4]

51 *idea of* react/reactant/burn/combine
idea of produce/product/formed/make
(NOT a chemical symbol equation)
methane + oxygen identified as reactants
carbon dioxide + water identified as products
each for 1 mark

[4]

52 B will have higher melting point
higher boiling point
be less volatile
be more viscous (allow less flammable)
any two for 1 mark each

[2]

53 (a) substances/chemicals/compounds
gains 1 mark

but gases (accept vapours)
gains 2 marks

heat (accept light)
for 1 mark
3

(b) carbon dioxide/CO_2
water (vapour)/H_2O
sulphur dioxide/SO_2
(accept correct formulae)
in any order for 1 mark each

3

[6]

54

(a) (i) oxygen (not air)

(ii) oxides/monoxides/dioxides
for 1 mark each

Do not allow specific examples

2

(b) (i) water

(ii) sulphur

(iii) carbon
for 1 mark each

3

(c) gives out/releases heat/energy
for 1 mark

1

(d) (i) carbon dioxide

(ii) carbon
for 1 mark each

(allow correct symbols/formulae)

2

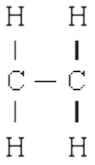
[8]

55

(a) smaller, more useful molecules more reactive (molecules)/(molecules) used to make plastics more easily ignited/better fuels produces unsaturated compounds/alkenes
any two for 1 mark each

2

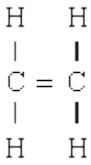
(b)



gains 1 mark

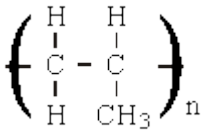
2

but



gains 2 marks

(c) (i)



for 1 mark

1

(ii) poly(propene)
(N.B. brackets not required; *allow* "polypropylene")
for 1 mark

1

[6]

56 (a) nitrogen / N2

[Do not allow N or N^2] for 1 mark

(b) heat

for 1 mark

(c) carbon dioxide / CO_2

for 1 mark

[3]

57

(a) • vertical axis appropriately scaled
[i.e. using more than half the grid]

• all three points correctly plotted* (to < ½ a square)

• reasonably straight line drawn through points (to < half a square)*
[*credit both these marks for bars correctly drawn since discontinuous variable]
each • for 1 mark

x [If points incorrectly plotted credit 1 mark for the best fit straight line or curve but not point-to-point]

3

(b) 44 (atomic units)
for 1 mark
(e.c.f. i.e. credit consistent with candidate's graph)

1

(c) hydrocarbons / alkanes
for 1 mark

1

(d) C_2H_6
C_5H_{12}
each for 1 mark

[NB figures must be subscripted]

2

[7]

58

(a) each bar correct height (2 bars) to less than ± ½ square
1 mark for each

both bars correctly labelled (in relation to size of bars)
for 1 mark

3

(b) less
gains 1 mark

but a lot less / much less / 18 times less or more if referring to coal
gains 2 marks

2

(c) (i) carbon
sulphur
for 1 mark each

2

(ii) *ideas that*

- at high temperatures, (produced when fuels burn)
- nitrogen and oxygen from atmosphere combine / react
for 1 mark each

2

[9]

59 (a) both bars correct height (to better than half a square)
1 mark for both

both bars correctly labelled
(w.r.t. relative heights if these incorrect)
for 1 mark

2

(b) a lot less / much less / 18 times less (converse must specify coal)
gains 1 mark

1

(c) *ideas that*

- at high temperatures (produced when fuels burn)
- nitrogen and oxygen from air / atmosphere combine / react
or nitrogen from air / atmosphere oxidises
for 1 mark each

2

(d) *ideas that*

- coal produces most carbon dioxide / more CO_2 than gas / oil
- because coal is (mostly) carbon
- gas produces less carbon dioxide than coal / oil
- oil and gas also contain hydrogen / contain more hydrogen atoms than carbon atoms / also produce water
any three for 1 mark each

3

(e) sulphur

for 1 mark

2

[9]