Mark schemes

Q1.

(a) use of oil has decreased by
0.8%
or
use of oil has decreased from
1.3% to 0.5%

1

use of solar energy has increased by 3.4%
or
use of solar energy has increased from 0% to 3.4%

allow any value below 0.05% for 2007

1

any one from:

- use of oil increased from 2007 to 2009
  no change in oil use between 2013 and 2015
  no change in solar energy use between 2007 and 2009

  allow use of oil was highest in 2009
- use of solar energy increased most between 2013 and 2015
- between 2007 and 2011 more oil was used and between 2013 and 2017 more solar energy was used

  if no other mark is awarded, allow 1 mark for oil decreased and solar energy increased

1

(b) Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

- carbon dioxide produced
- (which is) a greenhouse gas
- (therefore) surface temperature increases
- (therefore) global warming
- (so) climate change
- (so) polar ice caps melt
- (so) increasing sea levels

- (so) flooding
- (so) extreme weather events
- (so) reduction in biodiversity
- (so) famine / drought

- sulfur dioxide produced

- (which causes) acid rain
- (so) damage to buildings / statues
- (so) damage to trees
- (so) damage to aquatic animals
- (so) respiratory problems in humans

- carbon / soot produced

- (which are) particulates
- (which cause) global dimming
- (so) respiratory problems in humans

- carbon monoxide produced

- (which is) toxic

(c) solar is (a) renewable (source of energy)

allow oil is (a) finite (source of energy)

1

(d) any two from:
- sunshine is unreliable
- increased demand for energy
- lack of space

ignore references to cost

2

[12]

Q2.

(a) acid rain

1

(b) oxygen

1

carbon

must be in this order

1

(c) dimming

1

(d) $2\ CH_4 + 3\ O_2 \rightarrow 2\ CO + 4\ H_2O$

allow multiples

1

(e) air

1

oxygen

1

oxides of nitrogen

must be in this order

1

[8]

Q3.

(a) incomplete combustion

max 1 mark if soot wrongly identified

1

(because of) insufficient oxygen

1

(b) sulfur reacts with oxygen to form sulfur dioxide

allow SO_2 for sulfur dioxide

allow sulfur burns to form sulfur dioxide

1

(so) less sulfur dioxide emitted

1

(so) less acid rain

1

(so less) limestone reacts with acid rain

1

(c) (car engines work at) high temperatures

1

(so in the engine) nitrogen (from air) reacts with oxygen (from air)

1

[8]

Q4.

(a) colourless

1

odourless

1

toxic

1

any order

if more than three answers are given, apply the list principle as follows:

Number of answers	Number correct	Number incorrect	Mark awarded
4	3	1	2
	2	2	1
	1	3	0

5	3	2	1
	2	3	0
	1	4	0

(b) oxygen

allow air / O2

1

(c)

an answer of 24 (g) scores 2 marks

$\frac{36}{12} \times 8$

1

= 24 (g)

1

(d) animal waste

1

food in landfill

1

[8]

Q5.

(a) wood is renewable
or
(natural) gas is finite

1

(burning) wood produces the same amount of carbon dioxide as the trees absorbed

allow wood is carbon-neutral allow wood does not add to global warming

or
(burning natural) gas increases the amount of carbon dioxide (in the atmosphere)

allow (burning natural) gas adds to global warming
allow (burning natural) gas adds greenhouse gases (to the atmosphere)
ignore references to energy / cost

1

(b) not enough oxygen

allow not enough air
do not accept no oxygen / air

1

(so) incomplete combustion

1

(c) $2CH_4(g) + 3O_2(g) \rightarrow 2CO(g) + 4H_2O(g)$

allow correct multiples / fractions

1

(d)

an answer of 1250 (cm3 oxygen unreacted) scores 4 marks

ratio of O2 : CO2 = 5 : 3

1

(oxygen needed = $\frac{3.60 \times 5}{3}$)
= 6.0 (dm^3)

allow correct calculation using an incorrectly determined mole ratio

1

(oxygen unreacted = 7.25 − 6.0) = 1.25 (dm3)

allow correct subtraction of an incorrectly calculated volume of oxygen

1

(oxygen unreacted = 1.25 × 1000)
= 1250 (cm3)

allow correct conversion to cm3 anywhere in response
alternative approach for MP1 and MP2

1

moles CO2 = 0.15

and

moles O2 = 0.25 (1)
(0.25 x 24 =) 6.0 (dm3 oxygen needed) (1)

[9]

Q6.

(a) $C_{12}H_{26}$

1

(b) alkane

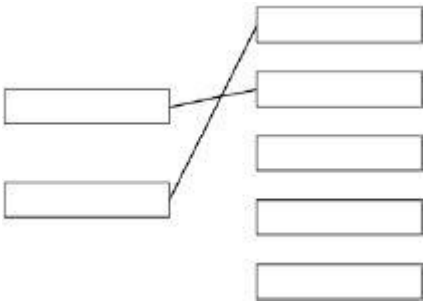
1

(c) air

allow atmosphere

1

(d)



particulates − global dimming

1

sulfur dioxide − acid rain

1

(e) carbon dioxide

1

carbon monoxide

1

(f) develop fuel efficient engines

use electric cars

1

[9]

Q7.

(a) incomplete combustion

1

(because) insufficient / limited oxygen supply

1

(b) any two from:

- carbon monoxide toxic / poisonous

  allow description of how carbon monoxide is toxic / poisonous
  ignore carbon monoxide is harmful / dangerous / deadly

- greater public concern / awareness about pollution

  ignore comments about the effects of other pollutants
  ignore unspecified comments about carbon monoxide pollution

- more cars so otherwise there would be more carbon monoxide entering atmosphere
- improved engine technology
- catalytic converters have been introduced

2

(c) any one from:

- (to reduce) health problems

  allow (to reduce) specified health problems e.g. breathing difficulties, asthma, lung cancer

- (to reduce) global dimming

  allow (to reduce) the effects of global dimming e.g. reduced light levels

allow (to reduce) smog
allow (to reduce) the formation of particulates
ignore global warming
do not accept to reduce soot

1

(d) nitrogen (from atmosphere) reacts with oxygen (from atmosphere)

1

at high temperature (in engine)
ignore heat / hot

or
with a spark (from spark plug)

1

(e) $2\ NO_2 \rightarrow N_2 + 2\ O_2$
allow multiples
if incorrect, allow N2 for 1 mark

2

(f) any one from:
- acid rain
  allow specific effects of acid rain
- respiratory problems
  allow specific respiratory problems e.g. breathing difficulties, asthma
- carbon monoxide
- global dimming or smog

2

max 1 mark if global warming mentioned

(g) transition metals

1

[12]

Q8.

(a) sulfur dioxide

1

(b) any one from:
- kills aquatic animals / plants
- damages limestone buildings / statues
- damage to forests

1

(c) (sample) C

1

contains most sulfur

or
produces most sulfur dioxide

1

(d) $1 \times \frac{66.3}{22.1}$

1

= 3 (kg)

1

an answer of 3 (kg) scores 2 marks

(e) any two from:

- not easily detected
- colourless
  allow cannot see it
- odourless
  allow cannot smell it

2

[8]

Q9.

(a) C_5H_{12}

1

(b) Alkanes

1

(c) (3) CO_2

1

(4) H_2O

1

allow for 1 mark
4 CO_2 + 3 H_2O

(d) contains hydrogen and carbon

1

(hydrogen and carbon) only

1

(e) *(diesel)*
produces more oxides of nitrogen
allow converse answers in terms of petrol

1

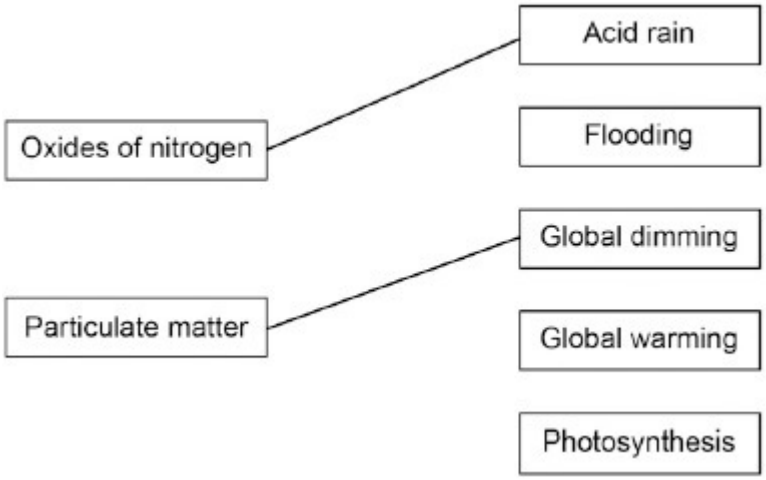
produces (more) particulate matter

1

produces less carbon dioxide

1

(f)


Acid rain
Flooding
Oxides of nitrogen
Global dimming
Particulate matter
Global warming
Photosynthesis

2

[11]