

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) $2 \text{CH}_4 + 3 \text{O}_2 \rightarrow 2 \text{CO} + 4 \text{H}_2\text{O}$
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 SO₂ 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) $2\text{CH}_4(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}(\text{g}) + 4\text{H}_2\text{O}(\text{g})$
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 (dm³)

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

1

alternative approach for MP1 and MP2

moles CO₂ = 0.15

and

moles O₂ = 0.25 (1)

(0.25 × 24 =) 6.0 (dm³ oxygen needed)

(1)

[9]

Q6.

(a) C₁₂H₂₆

1

(b) alkane

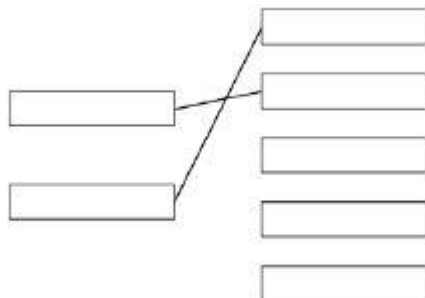
1

(c) air

allow atmosphere

1

(d)



	<i>particulates – global dimming</i>	1
	<i>sulfur dioxide – acid rain</i>	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:	
	<ul style="list-style-type: none"> carbon monoxide toxic / poisonous <i>allow description of how carbon monoxide is toxic / poisonous</i> <i>ignore carbon monoxide is harmful / dangerous / deadly</i> greater public concern / awareness about pollution <i>ignore comments about the effects of other pollutants</i> <i>ignore unspecified comments about carbon monoxide pollution</i> 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:	
	<ul style="list-style-type: none"> (to reduce) health problems <i>allow (to reduce) specified health problems e.g. breathing difficulties, asthma, lung cancer</i> (to reduce) global dimming <i>allow (to reduce) the effects of global dimming e.g. reduced light levels</i> 	

- 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) $2 \text{NO}_2 \rightarrow \text{N}_2 + 2 \text{O}_2$
- allow multiples*
if incorrect, allow N_2 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

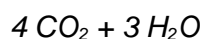
(c) (3) CO_2

1

(4) H_2O

1

allow for 1 mark



(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

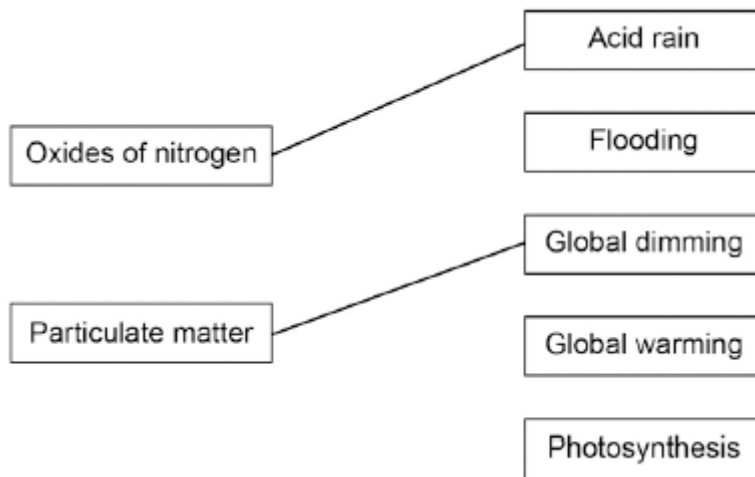
produces (more) particulate matter

1

produces less carbon dioxide

1

(f)



2

[11]