

Past-paper walk-through

Air quality and climate ■ 10.3

eXercise

Questions in this set

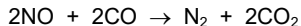
- 0620/21 N25 Q30 ■ 1 mark
- 0620/21 N25 Q31 ■ 1 mark
- 0620/22 N25 Q31 ■ 1 mark
- 0620/22 N25 Q33 ■ 1 mark
- 0620/23 N25 Q29 ■ 1 mark
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Question 30

0620/21 N25 ■ Q30 ■ 1 mark

30 Catalytic converters are used to remove oxides of nitrogen from exhaust gases.

The equation represents one of the reactions that occur in a catalytic converter.



What is a disadvantage of using a catalytic converter to remove oxides of nitrogen?

- A** CO is an essential reactant in photosynthesis.
- B** CO₂ is a greenhouse gas.
- C** N₂ is acidic.
- D** N₂ is toxic.

Solution 30

Answer: **B**

Why

- The converter does remove the toxic gases, which is its purpose.
- But the carbon monoxide is turned into carbon dioxide.
- Carbon dioxide is a greenhouse gas, so the converter increases the contribution to global warming.

Question 31

0620/21 N25 ■ Q31 ■ 1 mark

31 Some gases are present in clean, dry air, while other gases are **only** present in polluted air.

Which row is correct?

	a gas present in clean, dry air	a gas only present in polluted air
A	argon	carbon dioxide
B	argon	nitrogen dioxide
C	sulfur dioxide	carbon dioxide
D	sulfur dioxide	nitrogen dioxide

Solution 31

Answer: **B**

Why

- Clean dry air is about 78% nitrogen, 21% oxygen, with argon and a little carbon dioxide.
- So argon and carbon dioxide are both *normal* components.
- Sulfur dioxide and the oxides of nitrogen appear only when the air is polluted.

Question 31

0620/22 N25 ■ Q31 ■ 1 mark

31 Which statement about oxides of nitrogen is correct?

- A** They are made in car engines by the incomplete combustion of gasoline at a high temperature.
- B** They are made in car engines when nitrogen in gasoline reacts with oxygen in air at a high temperature.
- C** They are removed from car exhausts by catalytic converters and form nitrogen and sulfur dioxide.
- D** They are removed from car exhausts when they react with carbon monoxide in catalytic converters.

Solution 31

Answer: **D**

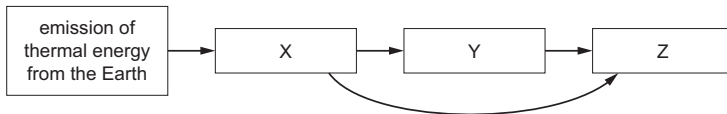
Why

- The nitrogen and the oxygen both come from the *air* drawn into the engine.
- The petrol contains no nitrogen, so it is not the source.
- The high temperature of combustion is what makes the two elements combine.

Question 33

0620/22 N25 ■ Q33 ■ 1 mark

- 33** The diagram represents two processes, X and Y, and their effect, Z, in increasing global warming.



Which row identifies X, Y and Z?

	X	Y	Z
A	absorption of thermal energy by greenhouse gases	emission of thermal energy to the Earth	reduced thermal energy loss to space
B	emission of thermal energy to the Earth	absorption of thermal energy by greenhouse gases	reduced thermal energy loss to space
C	absorption of thermal energy by greenhouse gases	reduced thermal energy loss to space	emission of thermal energy to the Earth
D	emission of thermal energy to the Earth	reduced thermal energy loss to space	absorption of thermal energy by greenhouse gases

Question 33

B	emission of thermal energy by greenhouse gases	emission of thermal energy to space	reduced thermal energy loss to space
C	absorption of thermal energy by greenhouse gases	emission of thermal energy to the Earth	increased thermal energy loss to space
D	emission of thermal energy by greenhouse gases	emission of thermal energy to space	increased thermal energy loss to space

Solution 33

Answer: **A**

Why

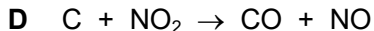
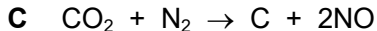
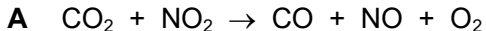
- Greenhouse gases absorb the thermal energy the Earth emits.
- They then re-emit it, and part of that radiation travels back down.
- The surface therefore receives energy twice over, which is what warms it.

Question 29

0620/23 N25 ■ Q29 ■ 1 mark

29 Cars are fitted with catalytic converters.

Which equation represents a reaction that takes place in a catalytic converter?



Solution 29

Answer: **B**

Why

- A catalytic converter must *remove* the harmful gases, so both CO and NO have to disappear.
- Carbon monoxide is oxidised to CO₂ and nitrogen monoxide is reduced to N₂.
- $2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$ does both at once.

Question 30

0620/23 N25 ■ Q30 ■ 1 mark

30 Three statements about greenhouse gases and global warming are listed.

- 1 A greenhouse gas molecule can absorb and emit thermal energy.
- 2 The Earth is a source of thermal energy.
- 3 Thermal energy emitted by a greenhouse gas molecule is sent out in all directions.

Which statements are correct?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Solution 30

Answer: **A**

Why

- A greenhouse gas molecule absorbs thermal radiation and then re-emits it – statement 1.
- The warm Earth is itself a source of that thermal energy – statement 2.
- Some of the re-emitted energy travels back down to the surface – statement 3, so all three hold.

Question 31

0620/21 J25 ■ Q31 ■ 1 mark

31 Which statements help explain why an increasing amount of carbon dioxide or methane in the atmosphere causes global warming?

- 1 Carbon dioxide absorbs thermal energy from the Earth.
- 2 Methane does **not** absorb thermal energy from the Sun.
- 3 Carbon dioxide does **not** reflect thermal energy from the Sun to the Earth.
- 4 Methane reflects thermal energy from the Earth back to the Earth.

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

Solution 31

Answer: **B**

Why

- Greenhouse gases absorb the *outgoing* thermal energy radiated by the Earth – statement 1 is right.
- They then re-radiate some of it back towards the surface, which is statement 4.
- Methane does absorb thermal energy, and it is the Earth's outgoing radiation that matters, not the Sun's incoming.

Question 32

0620/21 J25 ■ Q32 ■ 1 mark

32 The exhaust gases from cars contain oxides of nitrogen.

How are these oxides of nitrogen formed?

- A** Nitrogen and oxygen from the air react together at the high temperatures in the engine.
- B** Nitrogen and oxygen from the petrol react together in the car exhaust.
- C** Nitrogen from the petrol reacts with oxygen at the high temperatures in the engine.
- D** Nitrogen reacts with oxygen from the air in the catalytic converter.

Solution 32

Answer: **A**

Why

- The nitrogen and oxygen come from the *air* drawn into the engine, not from the petrol.
- Combustion makes the cylinder hot enough for the two to combine.
- So the oxides of nitrogen are formed inside the engine at high temperature.

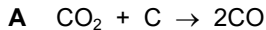
Question 30

0620/22 J25 ■ Q30 ■ 1 mark

30 Gases which cause acid rain form in car engines.

These gases can be removed using a catalytic converter.

Which equation represents the removal of one of these gases using a catalytic converter?



Solution 30

Answer: **B**

Why

- The gases that cause acid rain here are the oxides of nitrogen.
- In the converter nitrogen monoxide is reduced to nitrogen while carbon monoxide is oxidised.
- $2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$ deals with both at once.

Question 34

0620/22 M25 ■ Q34 ■ 1 mark

- 34** Nitrogen monoxide, NO, and carbon monoxide, CO, are both removed from the exhaust gases of a car by a catalytic converter.

Which statement describes how nitrogen monoxide and carbon monoxide are removed by a catalytic converter?

- A** Nitrogen monoxide and carbon monoxide are both reduced.
- B** Nitrogen monoxide and carbon monoxide are both oxidised.
- C** Nitrogen monoxide is oxidised and carbon monoxide is reduced.
- D** Nitrogen monoxide is reduced and carbon monoxide is oxidised.

Solution 34

Answer: **D**

Why

- Nitrogen monoxide is *reduced* to nitrogen.
- Carbon monoxide is *oxidised* to carbon dioxide.
- Both happen together on the catalyst surface, which is why one converter deals with both.