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19

## Maintaining Air Quality

For each question, choose the most suitable option and write the letter (A, B, C or D) in the brackets provided.

## Level 1

1. Which of the following shows the **correct** source and harmful effect of the air pollutant?

	Air Pollutant	Source	Harmful Effect
A	Carbon monoxide	Incomplete combustion of petrol in car engines	Loss of consciousness
B	Methane	Volcanic eruptions	Global warming
C	Nitrogen oxides	Burning of fossil fuels in industries	Acid rain
D	Ozone	Ozone layer	Photochemical smog

( )

2. Which of the following processes can regulate the amount of carbon dioxide in the air?

- A Combustion  
 B Decomposition of dead matter  
 C Photosynthesis  
 D Respiration

( )

3. Which of the following gases is **not** usually present in air?

- A Argon  
 B Carbon dioxide  
 C Carbon monoxide  
 D Water vapour

( )

4. Which of the following statements is/are **true** of acid rain?

- 1 Acid rain corrodes buildings.  
 2 Acid rain increases the pH of soil.  
 3 Acid rain is caused by combustion processes.

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

( )

5. Which of the following statements are always **true** of methane and carbon dioxide?

- 1 Both gases can be produced by cows.
- 2 Both gases cause acid rain.
- 3 Methane burns in limited oxygen to produce carbon dioxide.
- 4 They are both greenhouse gases.

- A 1 and 2 only  
 B 1 and 4 only  
 C 2 and 3 only  
 D 3 and 4 only

( )

**Level 2**

6. An unknown gas **J** is produced by animals such as sheep and cows. Gas **J** is able to trap heat very effectively. When gas **J** reacts with carbon, gas **H**, which causes breathing difficulties, is formed.

Which of the following is the **correct** identity of gases **J** and **H**?

	Gas J	Gas H
A	Carbon dioxide	Carbon monoxide
B	Carbon dioxide	Hydrogen
C	Methane	Carbon monoxide
D	Methane	Hydrogen

( )

7. Which of the following regarding sulfur dioxide are **true**?

	Property	Test	Observation
A	Acidic	Damp red litmus paper	Damp red litmus paper turns blue
B	Reducing agent	Acidified potassium manganate(VII) solution	Purple solution decolourises
C	Reducing agent	Aqueous potassium iodide	Colourless solution turns brown
D	Soluble in water	Add water	pH of water increases

( )

8. A landfill for the disposal of metals was present near an industrial area.  
The corrosion of the metal waste occurred quickly because \_\_\_\_\_.
- A acidic gases were produced by the industrial area
  - B rainfall was more frequent in the industrial area
  - C rusting occurred very quickly near the industrial area
  - D the temperature is higher near the industrial area
- ( )
9. Which of the following is **not** a result of too much carbon dioxide in the air?
- A A decrease in rainfall in rain-scarce areas
  - B An increase in the frequency of acid rain
  - C An increase in the reports of heat stroke
  - D The flooding of low-lying areas
- ( )

**Level 3**

10. A sample of polluted air was passed through heated calcium oxide.  
Which of the following is **not** a possible product formed?
- A Calcium carbonate
  - B Calcium nitrate
  - C Calcium nitride
  - D Calcium sulfite
- ( )
11. Hydrogen peroxide is allowed to decompose according to the set-up in Figure 19.1. The following experiment is set up to collect gas X that is produced from the decomposition of hydrogen peroxide.

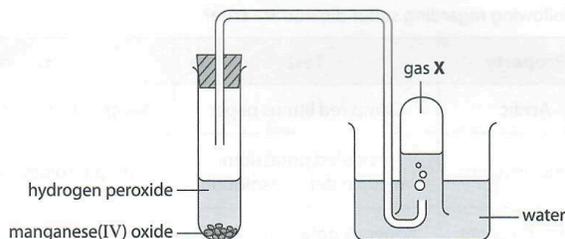


Figure 19.1

The first few tubes of gases are rejected as they contained impurities. What could be the identities of the impurity and gas X?

	Impurity	Gas X
A	Hydrogen peroxide	Oxygen
B	Manganese(IV) oxide	Hydrogen
C	Nitrogen	Oxygen
D	Oxygen	Hydrogen

( )

12. A catalytic converter is installed at the exhaust of every vehicle to allow certain gases to react with each other. One of the reactions present in the catalytic converter is as follows.



Which of the following is **not correct** about the catalytic converter?

- A As the frequency of complete combustion in car engines increases, less nitrogen oxides are removed by catalytic converters.
  - B Catalytic converters prevent acid rain.
  - C Catalytic converters prevent global warming.
  - D Catalytic converters remove harmful pollutants before they are released into the atmosphere. ( )
13. Four experiments were done to investigate the effect of oxygen gas on the volume of carbon monoxide and nitrogen oxides produced. In these experiments, various volumes of oxygen gas were introduced into a combustion engine filled with fuel. The results are shown in Table 19.1.

**Table 19.1**

Experiment	Volume of Oxygen Used / cm <sup>3</sup>	Volume of Carbon Monoxide Produced / cm <sup>3</sup>	Volume of Nitrogen Oxides Produced / cm <sup>3</sup>
1	500	200	120
2	600	180	140
3	700	160	170
4	800	120	190

Which of the following statements are **true** of the experiments?

- 1 An increase in the volume of oxygen gas increases the volume of both pollutants formed.
  - 2 When the temperature of the engine is high, more nitrogen–nitrogen triple bonds can be broken.
  - 3 When the temperature of the engine is low, more carbon monoxide is formed.
  - 4 When the volume of oxygen gas increases, the probability of complete combustion increases.
- A 1 and 2 only
  - B 1, 2 and 4 only
  - C 2, 3 and 4 only
  - D 3 and 4 only ( )

14. Figure 19.2 shows the reaction of zinc in air. When all the grey solid has turned yellow, the source of heat was removed. Upon cooling, the yellow solid turned white.

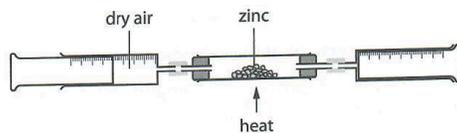


Figure 19.2

During the reaction, a sample of 250 cm<sup>3</sup> of air was used. What is the volume of air left after the experiment?

- A 52.5 cm<sup>3</sup>
  - B 105 cm<sup>3</sup>
  - C 197.5 cm<sup>3</sup>
  - D 395 cm<sup>3</sup> ( )
15. Study Figure 19.3 regarding biodiesel.

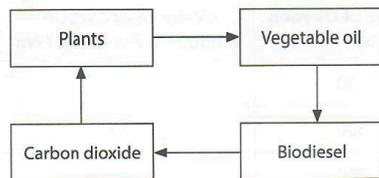


Figure 19.3

Which of the following statements is **not true**?

- A Biodiesel is biodegradable.
- B Biodiesel is a carbon-neutral fuel.
- C Plants only take in carbon dioxide.
- D Vegetable oil undergoes cracking to form biodiesel. ( )

4. Figure 1 shows the carbon cycle that involves the formation and the use of bioethanol.

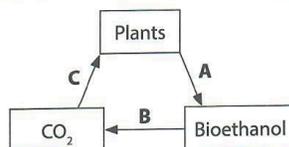


Figure 1

Which of the following statements is **not true** of the carbon cycle above?

- A** Bioethanol is a renewable resource.
- B** Process **A** could be the fermentation of glucose obtained from plants.
- C** Process **B** occurs in vehicle engines.
- D** Process **C** could be respiration. ( )
5. A hydrocarbon of the formula  $C_nH_n$  does **not** decolourise aqueous bromine in the dark.  
What is the value of  $n$ ?
- A** 6
- B** 8
- C** 10
- D** 12 ( )
6. A hydrocarbon with a molecular mass of 44 reacts with a halogen to form two products.  
What could be the structural formula of the hydrocarbon?
- A**  $\begin{array}{c} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array}$
- B**  $\begin{array}{c} \text{H} & \text{H} \\ | & | \\ \text{C} & = & \text{C} \\ | & | \\ \text{H} & \text{H} \end{array}$
- C**  $\begin{array}{c} \text{H} & \text{H} & \text{H} & \text{H} \\ | & | & | & | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$
- D**  $\begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{C} & = & \text{C}-\text{C}-\text{H} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array}$  ( )

# Revision Paper 3

For each question, choose the most suitable option and write the letter (A, B, C or D) in the brackets provided.

1. Which of the following is **not true** of the products formed when fossil fuels are burnt?

- A They damage the ozone layer.  
 B They irritate the skin.  
 C They might cause acid rain.  
 D They might cause global warming.

( )

2. Decane,  $C_{10}H_{22}$ , can be cracked to form useful compounds like short-chain alkanes, alkenes and hydrogen gas.

Which of the following could be the balanced equation for the cracking of decane to form these useful products?

- A  $C_{10}H_{22} \rightarrow 5C_2H_4 + H_2$   
 B  $C_{10}H_{22} \rightarrow CH_4 + 3C_3H_6$   
 C  $C_{10}H_{22} \rightarrow 2CH_4 + 4C_2H_4$   
 D  $C_{10}H_{22} \rightarrow C_3H_8 + C_3H_6 + 2C_2H_4$

( )

3. Petroleum can be separated into different fractions containing a mixture of hydrocarbons. Some of the fractions obtained can be used as fuels. One such fraction is called gasoline.

Which of the following is a similarity and a difference between gasoline and bioethanol?

	Similarity	Difference
A	Both fuels are obtained from renewable resources.	Bioethanol is obtained from plants while gasoline is obtained from dead organic matter.
B	Both fuels are obtained from renewable resources.	Gasoline is a carbon-neutral fuel while bioethanol is not.
C	Both fuels burn completely in air to form carbon dioxide and water.	Bioethanol is obtained from plants while gasoline is obtained from dead organic matter.
D	Both fuels burn completely in air to form carbon dioxide and water.	Gasoline is a carbon-neutral fuel while bioethanol is not.

( )

7. If the third member of an unknown homologous series is  $C_4H_8O$ , what is the formula of the **first** member of the series?

- A  $CH_2O$
- B  $C_2H_4O$
- C  $C_3H_6O$
- D  $CO_2$

( )

8. Which of the following statements is **true** of ethane and ethene?

- A Both ethane and ethene react with chlorine to form  $C_2H_5Cl$ .
- B Both ethane and ethene require the same conditions to react with bromine.
- C Ethane can undergo cracking to form ethene.
- D Ethane can undergo a substitution reaction to form ethene.

( )

9. Margarine can be produced from vegetable oils via the addition of hydrogen in the presence of nickel catalyst. In an experiment, the volume of hydrogen gas used to convert 1 mol of a vegetable oil to margarine was recorded. The data is found in Table 1.

**Table 1**

Vegetable Oil	Volume of Hydrogen Gas Used / $dm^3/mol$
A	0
B	24
C	48
D	96

Which of the following statements are **correct**?

- 1 Vegetable oil **A** is saturated.
- 2 Vegetable oil **B** has the greatest number of double bonds.
- 3 Vegetable oil **C** has more double bonds than vegetable oil **B**.
- 4 Vegetable oil **D** contains four carbon-carbon double bonds.

- A 1, 2 and 4 only
- B 1, 3 and 4 only
- C 2 and 3 only
- D 3 and 4 only

( )

10. Study the reaction scheme in Figure 2.

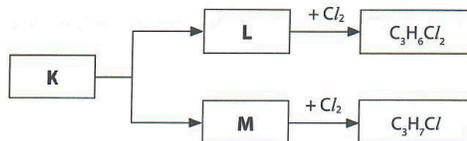


Figure 2

Which of the following are the **correct** chemical formulae of compounds K to L?

	K	L	M
A	$\text{C}_3\text{H}_6$	$\text{C}_3\text{H}_6$	$\text{C}_3\text{H}_8$
B	$\text{C}_3\text{H}_8$	$\text{C}_3\text{H}_8$	$\text{C}_3\text{H}_6$
C	$\text{C}_6\text{H}_{14}$	$\text{C}_3\text{H}_6$	$\text{C}_3\text{H}_8$
D	$\text{C}_6\text{H}_{14}$	$\text{C}_3\text{H}_8$	$\text{C}_3\text{H}_6$

( )

11. Similar to alkanes and alkenes, alkynes are another homologous series which can be termed as hydrocarbons. The first member of the series is ethyne,  $\text{C}_2\text{H}_2$ .

Predict the molecular formula of propyne and hence, the general formula of alkynes.

	Molecular Formula of Propyne	General Formula of Alkynes
A	$\text{C}_3\text{H}_4$	$\text{C}_n\text{H}_{2n-1}$
B	$\text{C}_3\text{H}_4$	$\text{C}_n\text{H}_{2n-2}$
C	$\text{C}_3\text{H}_6$	$\text{C}_n\text{H}_{2n}$
D	$\text{C}_3\text{H}_6$	$\text{C}_n\text{H}_{2n+2}$

( )

12. Which of the following is the **correct** chemical formula of the product formed when aqueous ammonia reacts with propanoic acid?

- A  $\text{C}_2\text{H}_5\text{CONH}_2$
- B  $\text{C}_3\text{H}_7\text{CONH}_2$
- C  $\text{C}_2\text{H}_5\text{COONH}_4$
- D  $\text{C}_3\text{H}_7\text{COONH}_4$

( )

13. An organic molecule has the chemical formula  $C_5H_{12}O$ .  
 What is the name of the homologous series that the molecule likely belongs to?

A Alcohols  
 B Alkanes  
 C Alkenes  
 D Carboxylic acid

( )

14. An alcohol can be converted into a carboxylic acid via the \_\_\_\_\_ reaction.

A addition  
 B combustion  
 C condensation  
 D oxidation

( )

15. The structure of compound X is shown in Figure 3.

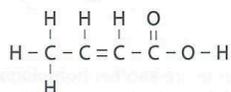
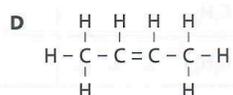
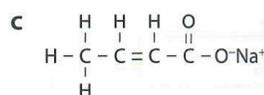
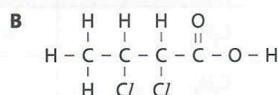
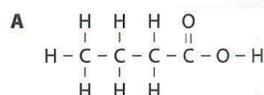


Figure 3

Which of the following structures is **not** a possible product obtained from a reaction involving compound X?



( )

16. Which of the following chemical formulae may be that of an unsaturated carboxylic acid?

- 1  $C_{12}H_{21}COOH$
  - 2  $C_{12}H_{23}COOH$
  - 3  $C_{12}H_{25}COOH$
  - 4  $C_{12}H_{27}COOH$
- A 1 and 2 only  
 B 1 and 3 only  
 C 2 and 4 only  
 D 3 and 4 only

( )

17. Which of the following is **true** of polyethene and polypropene?

- A It is cheap to recycle both materials.
- B The chemical method to recycle them is to convert them into small pellets.
- C The improper disposal of both materials may cause water pollution.
- D Their monomers are saturated.

( )

18. Two different alkenes formed an additional polymer. Part of the polymer is shown in Figure 4.

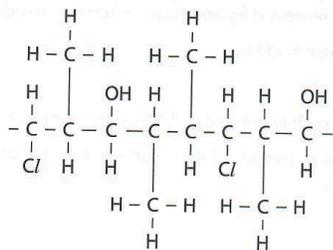
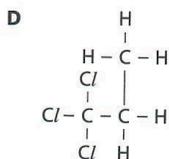
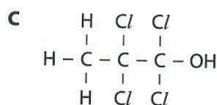
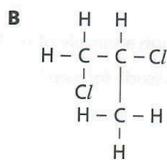
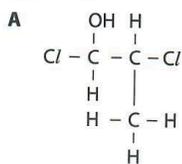


Figure 4

Which of the following could be the product formed when one of the monomers reacts with chlorine gas?



( )

19. Carbon monoxide is an air pollutant because \_\_\_\_\_.
- A it can cause the loss of consciousness
  - B it is a greenhouse gas
  - C it is the main component in photochemical smog
  - D it increases the pH of soils
- ( )
20. Which of the following is **not** a process that is involved in the recycling of plastics?
- A Cracking
  - B Grinding
  - C Polymerisation
  - D Sorting
- ( )
21. A sample of polluted air contains carbon dioxide, methane, nitrogen, nitrogen dioxide and oxygen.
- Which of the following statements is **true** of the sample of polluted air?
- A One of the gases contribute to global warming.
  - B Two of the gases are neutral.
  - C Two of the gases can be removed by aqueous sodium hydroxide.
  - D Two of the gases can cause acid rain.
- ( )
22. The air that we breathe in is mainly made up of nitrogen, oxygen, carbon dioxide and argon.
- Given that the air we breathe in contains 0.44 % carbon dioxide, calculate the average relative molecular mass of air.
- A 28.0
  - B 28.8
  - C 29.0
  - D 29.8
- ( )
23. 50 cm<sup>3</sup> of dry air is passed through a sample of sodium metal.
- What is the mass of the sodium oxide formed?
- A 0.0403 g
  - B 0.0543 g
  - C 0.192 g
  - D 0.258 g
- ( )

24. When a sample of unpolluted air was ignited, the components in the air reacted with one another.

Which gas would **not** be present after the reaction?

- A Argon
- B Carbon monoxide
- C Nitrogen dioxide
- D Nitrogen monoxide

( )

25. A mixture of gases was passed through the following solutions as shown in Figure 5.

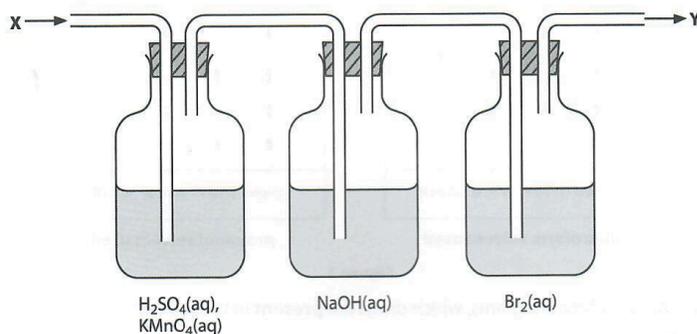


Figure 5

Which of the following could be the gases present at X and Y?

	X	Y
A	Carbon dioxide, methane, propene and sulfur dioxide	Methane
B	Carbon monoxide, ethane and nitrogen	Ethane
C	Carbon monoxide, hydrogen chloride, propane and sulfur dioxide	Carbon monoxide
D	Methane, propane and propene	Propane and propene

( )