Air

Question Paper 2

Level	IGCSE
Subject	Chemistry
ExamBoard	CIE
Topic	Air and Water
Sub-Topic	Air
Paper	(Extended) Theory
Booklet	Question Paper 2

TimeAllowed: **81 minutes**

Score: **/ 67**

Percentage: **/100**

1 The reactions in this question are all examples of photochemical reactions.

(a) Explain the phrase *photochemical reaction*.

.....

..... [2]

(b) Many millions of years ago, the Earth's atmosphere was rich in carbon dioxide and contained negligible amounts of oxygen. After the appearance of green plant-like bacteria, the proportions of these two gases in the atmosphere changed.

(i) What are the approximate percentages of these two gases in the atmosphere now?

carbon dioxide = ... [1]

oxygen = ... [1]

(ii) Explain how the green plant-like bacteria changed the composition of the atmosphere.

.....

.....

.....

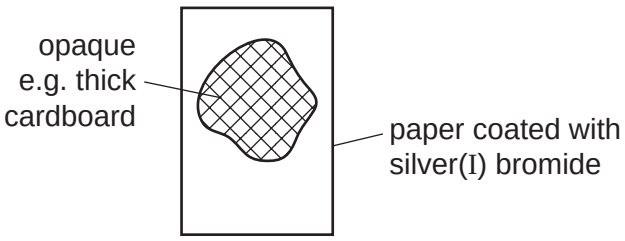
..... [4]

(c) The reduction of silver(I) bromide to silver is the basis of film photography.

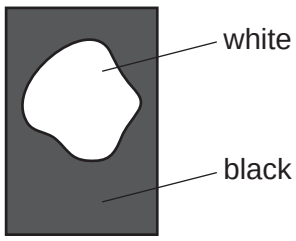
$$2AgBr \rightarrow 2Ag + Br_2$$

white black

An opaque object is placed on a piece of paper coated with silver(I) bromide which is then exposed to a bright light. The light is switched off and the opaque object removed.



before exposed to light



after exposed to light
cardboard removed

Explain how the image is formed.

.....

.....

..... [4]

[Total: 12]

2 Minimising air pollution is essential for health and for the environment.

(a) Natural gas is methane.

(i) Write the equation for complete combustion of methane.

..... [2]

(ii) Explain why it is dangerous to use a gas fire in a poorly ventilated room.

.....

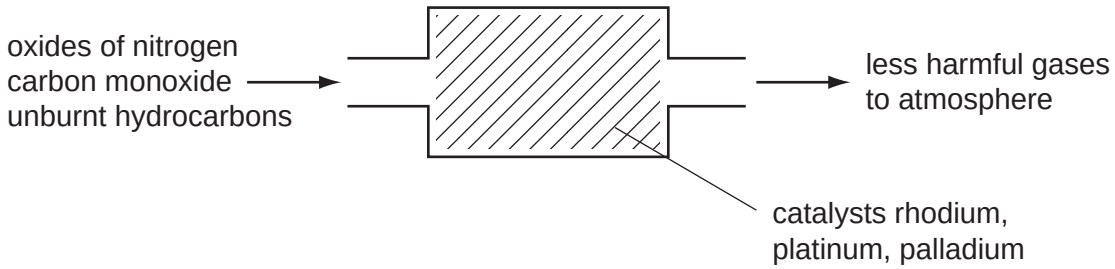
..... [2]

(b) Low sulphur fuels are being introduced. Ordinary diesel contains 500 ppm of sulphur but low sulphur diesel contains less than 50 ppm. Why is this an advantage to the environment?

.....

..... [2]

(c) Catalytic converters reduce pollution from motor vehicles, as shown in the following diagram.



(i) What type of elements are the metals rhodium, platinum and palladium?

..... [1]

(ii) Rhodium catalyses the decomposition of the oxides of nitrogen.

$$2NO \rightarrow N_2 + O_2$$

Two other pollutants are carbon monoxide and unburnt hydrocarbons. How are they made into less harmful substances?

.....

..... [2]

3 **(a** Two of the gases in air are nitrogen and oxygen. Name **two** other gases present in unpolluted air.

[2]

(b) Two common pollutants present in air are sulphur dioxide and lead compounds. State the source and harmful effect of each.

sulphur dioxide

source	
harmful effect	[3]

lead compounds

source	
harmful effect	[2]

(c) Respiration and photosynthesis are two of the processes that determine the percentage of oxygen and of carbon dioxide in the air.

(i) Name another process that changes the percentages of these two gases in air.

[1]

(ii) The equation for photosynthesis is given below.

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

This is an endothermic reaction.

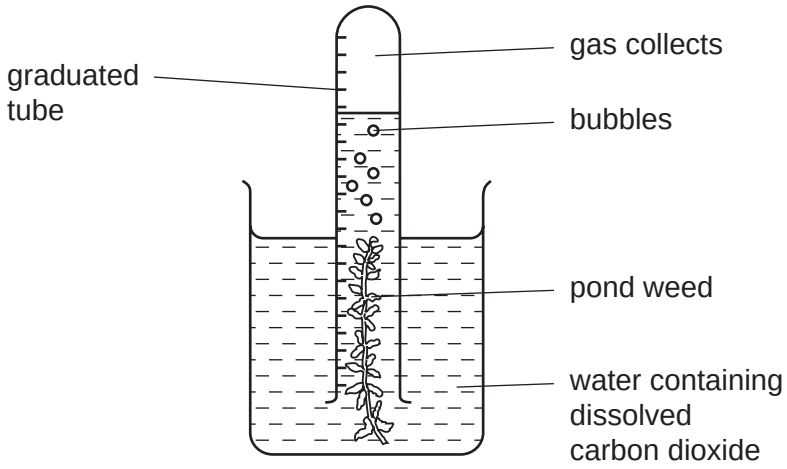
Complete the reaction for respiration.

$C_6H_{12}O_6 + 6O_2 \longrightarrow$ [ ] + [ ]

This is an [ ] reaction.

[2]

(d) The rate of photosynthesis of pond weed can be measured using the following experiment.



(i) Describe how you could show that the gas collected in this experiment is oxygen.

[1]

(ii) What measurements are needed to calculate the rate of this reaction?

[2]

(iii) What would be the effect, and why, of moving the apparatus further away from the light?

.....

[2]

4 Nitrogen dioxide, NO_2, is a dark brown gas.

(a) Most metal nitrates decompose when heated to form the metal oxide, nitrogen dioxide and oxygen.

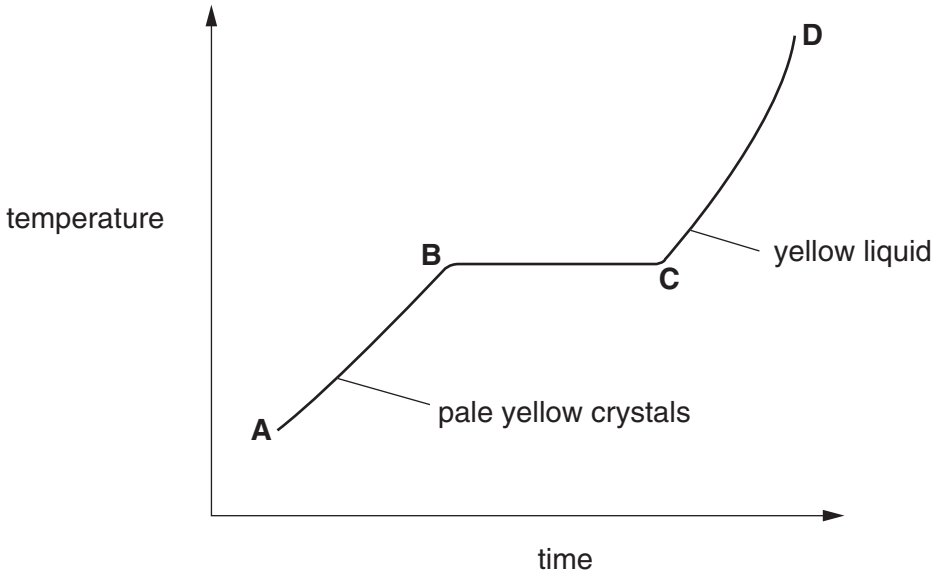
(i) Write a symbol equation for the decomposition of lead(II) nitrate.

$Pb(NO_3)_2 \rightarrow$ ..... + ... + ... [2]

(ii) Potassium nitrate does not form nitrogen dioxide on heating. Write the word equation for its decomposition.

.....[1]

(b) When nitrogen dioxide is cooled, it forms a yellow liquid and then pale yellow crystals. These crystals are heated and the temperature is measured every minute. The following graph can be drawn.



(i) Describe the arrangement and movement of the molecules in the region **A**–**B**.

.....

.....

(ii) Name the change that occurs in the region **B**–**C**

.....[4]

(c) Nitrogen dioxide and other oxides of nitrogen are formed in car engines.

(i) Explain how these oxides are formed.

.....

.....

(ii) How are they removed from the exhaust gases?

.....

.....[4]

(d) Nitrogen dioxide, oxygen and water react to form dilute nitric acid.
Describe how lead(II) nitrate crystals could be prepared from dilute nitric acid and lead(II) oxide.

.....

.....

.....[3]

5 The speed (rate) of a chemical reaction depends on a number of factors which include temperature and the presence of a catalyst.

(a) Reaction speed increases as the temperature increases.

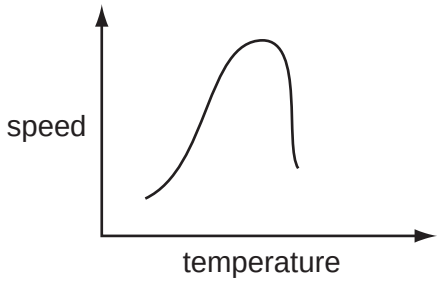
(i) Explain why reaction speed increases with temperature.

.....

.....

..... [3]

(ii) Reactions involving enzymes do not follow the above pattern.
The following graph shows how the speed of such a reaction varies with temperature.



Suggest an explanation why initially the reaction speed increases then above a certain temperature the speed decreases.

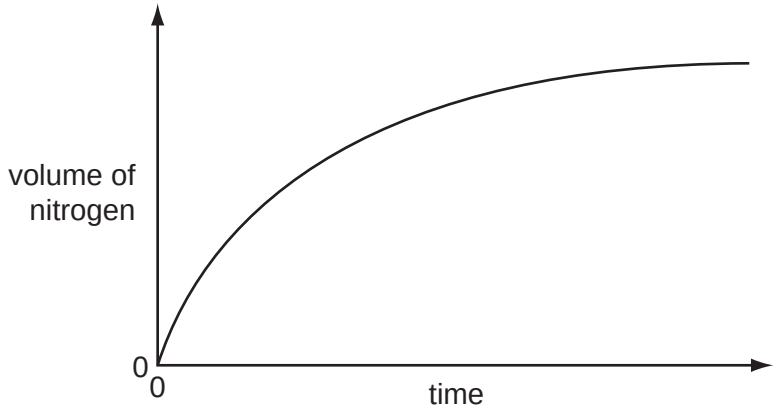
.....

..... [2]

(b) An organic compound decomposes to give off nitrogen.

$$C_6H_5N_2Cl(aq) \rightarrow C_6H_5Cl(l) + N_2(g)$$

The speed of this reaction can be determined by measuring the volume of nitrogen formed at regular intervals. Typical results are shown in the graph below.



(i) The reaction is catalysed by copper.
Sketch the graph for the catalysed reaction on the diagram above. [2]

(ii) How does the speed of this reaction vary with time?

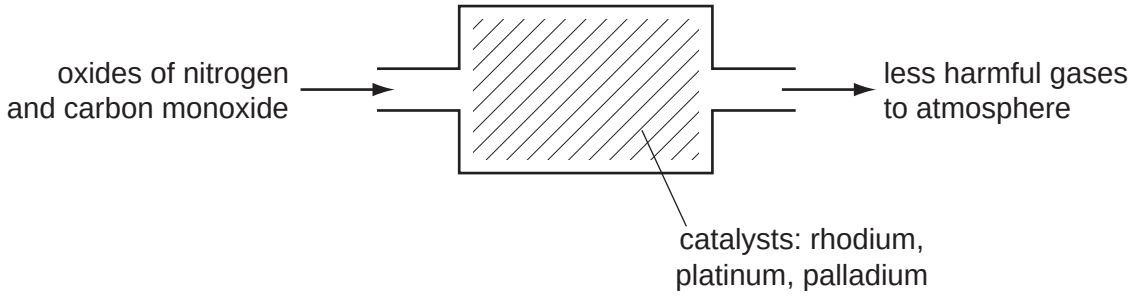
..... [1]

(iii) Why does the speed of reaction vary with time?

.....

..... [2]

(c) Catalytic converters reduce the pollution from motor vehicles.



(i) Describe how carbon monoxide and the oxides of nitrogen are formed in car engines.

.....

.....

.....

..... [4]

(ii) Describe the reaction(s) inside the catalytic converter which change these pollutants into less harmful gases. Include at least one equation in your description.

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..... [3]

[Total: 17]