Chemistry of the environment – 2021 O Level

1. Nov/2021/Paper_11/No.35

The carbon cycle regulates the amount of carbon dioxide in the atmosphere.

Combustion, photosynthesis and respiration are involved in this cycle.

How do these processes affect the amount of carbon dioxide in the atmosphere?

	combustion	photosynthesis	respiration
A	increases	increases	increases
B	increases	decreases	increases
C	decreases	increases	decreases
D	decreases	decreases	decreases

2. Nov/2021/Paper_12/No.35

Which statements are correct?

1 Chlorination is used to remove unpleasant tastes from drinking water.

2 Desalination can be achieved using distillation.

3 The presence of phosphates in water and soil encourages plant growth.

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

3. Nov/2021/Paper_21/No.2

Dry air contains nitrogen, oxygen, noble gases and carbon dioxide.

(a) State the percentage of oxygen present in dry air.

..... [1]

(b) Carbon dioxide is removed from a sample of air by passing the air through aqueous sodium hydroxide.

Explain why aqueous sodium hydroxide removes carbon dioxide from air.

.....

.....

..... [2]

(c) Describe how oxygen, nitrogen and the noble gases are separated from each other after carbon dioxide has been removed.

.....

..... [2]

(d) Describe the test for oxygen.

test .....

observation .....

[2]

(e) Ozone, O_3, is formed in the atmosphere by the reaction of nitrogen dioxide with oxygen in the presence of ultraviolet light.

(i) State the type of chemical reaction that takes place when ozone is formed in this way.

..... [1]

(ii) Nitrogen dioxide is formed in internal combustion engines.

State one other source of nitrogen dioxide in the atmosphere.

..... [1]

(f) A layer of ozone is present high in the atmosphere.

State one problem for humans that can arise if the ozone layer is depleted by CFCs.

..... [1]

[Total: 10]

4. Nov/2021/Paper_22/No.2

This question is about pollutant gases.

(a) Hydrocarbons such as octane are used as fuels for cars.

The list shows the gases present in a car exhaust.

carbon dioxide
carbon monoxide
nitrogen
nitrogen dioxide
octane
water vapour

State which two gases in the list show that incomplete combustion has taken place in this car engine.

1 .....

2 .....

[2]

(b) Describe a test for carbon dioxide.

test .....

observation .....

[2]

(c) Two natural sources of methane in the atmosphere are from leaks of natural gas and waste gases from animals.

Give one other natural source of methane in the atmosphere.

..... [1]

(d) Complete this sentence about the effect of an increase in the concentration of methane in the atmosphere.

Methane is a ..... gas because it absorbs and then re-emits infrared radiation. This contributes to an increase in temperature of the atmosphere which is called ....

[2]

(e) Cars are fitted with catalytic converters to reduce the amount of harmful pollutant gases from car exhausts.

Describe how catalytic converters remove pollutant gases from car exhausts.

.....

.....

.....

.....

..... [3]

[Total: 10]

5. Jun/2021/Paper_11/No.23

The water in a lake is acidic and the fish are dying. The water in the lake needs to be neutralised.

Which compound can be added in excess to neutralise the water in the lake?

A calcium carbonate

B phosphoric acid

C potassium hydroxide

D sodium nitrate

6. Jun/2021/Paper_11/No.24

Which statement about gases in the atmosphere is correct?

A Carbon monoxide is a pollutant which causes acid rain.

B Catalytic converters reduce carbon monoxide to carbon dioxide.

C Methane in the atmosphere depletes the ozone layer.

D Photosynthesis adds oxygen to the atmosphere.

7. Jun/2021/Paper_21/No.6

Carbon dioxide and water vapour are greenhouse gases found in air.

(a) (i) Name one **other** greenhouse gas.

..... [1]

(ii) State **one** environmental problem that may be caused by an increase in the percentage of carbon dioxide in the air.

..... [1]

(b) Draw the dot-and-cross diagram to show the bonding in a molecule of carbon dioxide.

Only show the outer shell electrons.

[1]

(c) Some power stations burn methane, CH_4.

Construct the equation to show the complete combustion of methane.

..... [1]

(d) The carbon dioxide made in power stations can be removed by a reversible reaction with water.

$$CO_2(g) + H_2O(l) \rightleftharpoons H_2CO_3(aq)$$

The forward reaction is exothermic.

(i) The concentration of carbon dioxide is increased.

The temperature is kept constant.

Predict and explain how the position of equilibrium changes.

.....

.....

..... [2]

(ii) The temperature of the water is increased.

All other conditions are kept constant.

Predict and explain how the position of equilibrium changes.

.....

.....

..... [2]

(e) Carbonic acid, $H_2CO_3(aq)$, is a weak acid.

(i) What is the meaning of the term *weak* in weak acid?

.....

..... [1]

(ii) Carbonic acid contains a small concentration of carbonate ions, $CO_3^{2-}(aq)$.

If carbonic acid is pumped deep underground, the $CO_3^{2-}(aq)$ will react with metal ions to form insoluble carbonates.

Write the ionic equation for the reaction of magnesium ions with $CO_3^{2-}(aq)$.

..... [1]

[Total: 10]

8. Jun/2021/Paper_22/No.6

Sulfur dioxide and oxides of nitrogen are pollutants found in air.

(a) State one environmental problem caused by the presence of sulfur dioxide in the air.

..... [1]

(b) Coal-fired power stations produce sulfur dioxide as a pollutant.

The sulfur dioxide produced is prevented from entering the air by a process called flue gas desulfurisation, FGD.

Name the compound used in FGD that reacts with the sulfur dioxide.

..... [1]

(c) Coal-fired power stations also produce oxides of nitrogen such as NO.

NO is produced when nitrogen, N_2, reacts with oxygen.

(i) Construct the equation for this reaction.

..... [1]

(ii) Draw a dot-and-cross diagram to show the bonding in a molecule of nitrogen.

Only include the outer shell electrons.

[1]

(iii) Explain why the rate of reaction between nitrogen and oxygen increases as the temperature increases.

.....

.....

..... [2]

(d) Nitrogen dioxide, NO_2, reacts with water to form a mixture of dilute nitric acid, HNO_3, and dilute nitrous acid, HNO_2.

$$2NO_2 + H_2O \rightarrow HNO_2 + HNO_3$$

(i) Nitrogen dioxide reacts with aqueous sodium hydroxide to form two different salts and water.

Construct the equation for this reaction.

..... [2]

(ii) Nitric acid is a strong acid.

Nitrous acid is a weak acid.

Describe the difference between a weak acid and a strong acid.

.....

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..... [2]

[Total: 10]