# Chemical energetics – 2021 O Level

**1.** Nov/2021/Paper_11/No.16

Which process is endothermic?

**A** atoms bonding to form molecules

**B** the chemical reaction occurring in a fuel cell

**C** the reaction of carbon dioxide and water to produce glucose and oxygen

**D** the reaction of methane with oxygen to produce water and carbon dioxide

**2.** Nov/2021/Paper_11/No.17

The reaction of hydrogen with chlorine to form gaseous hydrogen chloride is exothermic.

Which statement is correct?

**A** The total energy of bond formation is greater than the total energy of bond breaking.

**B** The total energy of bond breaking is greater than the total energy of bond formation.

**C** The temperature of the reaction mixture falls during the reaction.

**D** The temperature of the reaction mixture remains unchanged during the reaction.

**3.** Nov/2021/Paper_11/No.18

The equation shows the reaction for the manufacture of ammonia.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Which change will decrease the activation energy of the reaction?

**A** addition of a catalyst

**B** decrease in temperature

**C** increase in concentration

**D** increase in pressure

**4.** Nov/2021/Paper_11/No.26

The manufacture of sulfuric acid by the Contact process involves the use of three different raw materials.

How many of these raw materials are elements, how many are compounds and how many are mixtures?

| | elements | compounds | mixtures |
|---|---|---|---|
| **A** | 0 | 3 | 0 |
| **B** | 1 | 2 | 0 |
| **C** | 1 | 1 | 1 |
| **D** | 2 | 0 | 1 |

**5.** Nov/2021/Paper_12/No.16

The equation shows the reaction of glucose with oxygen.

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

Which statement about this reaction is correct?

**A** It can occur in the dark.

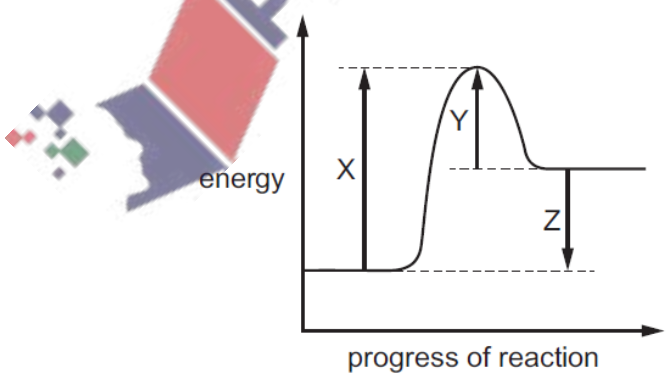
**B** It is endothermic.

**C** It needs chlorophyll as a catalyst.

**D** It occurs in plants but not in animals.

**6.** Nov/2021/Paper_12/No.17

The energy profile diagram of a chemical reaction is shown.




Which statement is correct?

**A** The reaction is exothermic.

**B** X represents the activation energy for the reaction.

**C** Y represents $\Delta H$ for the reaction.

**D** Z represents the energy given out as the reaction proceeds.

**7.** Nov/2021/Paper_21/No.5

Magnesium undergoes oxidation when it reacts with aqueous silver nitrate.

$$Mg + 2Ag^{+} \rightarrow Mg^{2+} + 2Ag$$

**(a)** Explain how this equation shows that magnesium is oxidised.

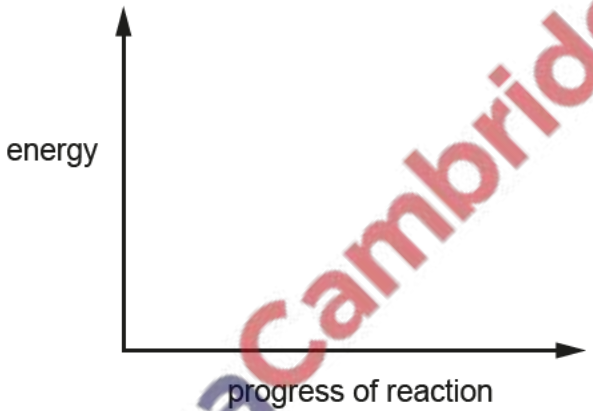
.....

..... [1]

**(b)** The reaction of magnesium with silver nitrate is exothermic.

Complete the energy profile diagram for this reaction.

Label reactants, products and $\Delta H$.




[2]

**(c)** Acidified aqueous silver nitrate is added to a solution containing halide ions.
A yellow precipitate is observed.

State the name of the halide ion present in the solution.

..... [1]

**(d)** Silver is a metal.

Use your knowledge of the structure of metals to explain why silver is malleable.

.....

.....

..... [2]

**(e)** The table gives information about the thermal decomposition of some metal carbonates.

| metal carbonate | ease of thermal decomposition |
|---|---|
| calcium carbonate | decomposes at 900 °C |
| magnesium carbonate | decomposes at 540 °C |
| sodium carbonate | does not decompose below 1000 °C |

Describe how the ease of thermal decomposition depends on the position of these metals in the reactivity series.

.....

..... [1]

[Total: 7]

**8.** Nov/2021/Paper_21/No.6

Chlorine reacts with phosphorus to form phosphorus(III) chloride.

$$3Cl_2 + 2P \rightarrow 2PCl_3$$

The reaction is exothermic.

**(a)** Explain in terms of bond breaking and bond forming why the reaction is exothermic.

.....

.....

..... [2]

**(b)** **(i)** When chlorine reacts with aqueous potassium iodide a brown solution is formed.

Name the products of this reaction.

..... and ..... [1]

**(ii)** When aqueous bromine is added to potassium chloride there is no reaction.

Explain why there is no reaction.

..... [1]

**(c)** Phosphorus(III) chloride reacts with water to form a mixture of phosphorous acid, $H_3PO_3$, and hydrochloric acid.

Construct the equation for this reaction.

..... [1]

[Total: 5]

**9.** Nov/2021/Paper_22/No.6

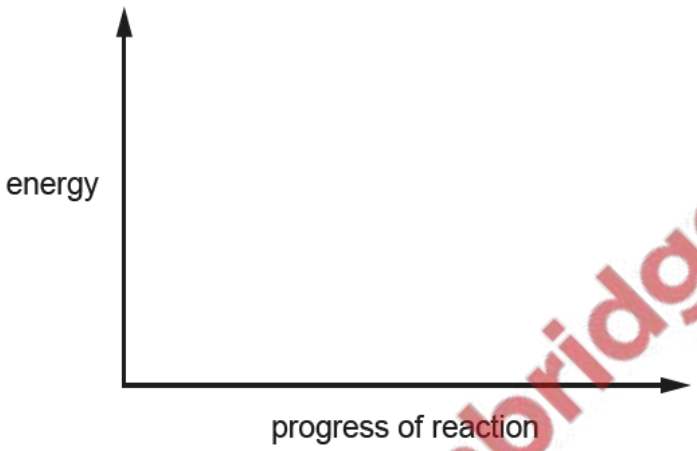
Phosphorus reacts with hydrogen to produce phosphine, $PH_3$.

$$2P + 3H_2 \rightarrow 2PH_3$$

The reaction is endothermic.

**(a)** Complete the energy profile diagram for this reaction.

Label reactants, products and $\Delta H$.




[2]

**(b)** Explain, in terms of bond breaking and bond forming, why the reaction is endothermic.

.....

.....

..... [2]

**(c)** Phosphine reacts with oxygen to form phosphorus(V) oxide, $P_4O_{10}$, and water.

Complete the equation for this reaction.

..... $PH_3$ + ..... $O_2$ → $P_4O_{10}$ + ..... $H_2O$ [1]

[Total: 5]

**10.** Jun/2021/Paper_12/No.20

Solution X is colourless. A few drops of aqueous potassium iodide solution are added to a sample of X. No change is seen.

Solution Y is colourless. A few drops of aqueous acidified potassium manganate(VII) solution are added to a sample of Y. The colour of the potassium manganate(VII) disappears.

What can be deduced about X and Y from these two observations?

**A** X and Y are both reducing agents.

**B** X is an oxidising agent and Y is **not** a reducing agent.

**C** X is **not** a reducing agent and Y is an oxidising agent.

**D** X is **not** an oxidising agent and Y is a reducing agent.