Chemical Energetics – 2020 IGCSE

1. June/2022/Paper_11/No.9

Which equation for the decomposition of calcium nitrate is correct?

A $Ca(NO_3)_2 \rightarrow CaO + NO_2 + O_2$

B $Ca(NO_3)_2 \rightarrow CaO + 2NO_2 + O_2$

C $2Ca(NO_3)_2 \rightarrow 2CaO + 2NO_2 + O_2$

D $2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$

2. June/2022/Paper_11/No.13

The equation for the reaction when hydrogen is used as a fuel is shown.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Which statement about this reaction is correct?

A Energy is given out so the temperature of the surroundings decreases.

B Energy is taken in so the temperature of the surroundings increases.

C The reaction is endothermic so the temperature of the surroundings decreases.

D The reaction is exothermic so the temperature of the surroundings increases.

3. June/2022/Paper_11/No.14

Which fuels release carbon dioxide when burned?

1 gasoline

2 hydrogen

3 methane

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

4. June/2022/Paper_12/No.15

Water is added to anhydrous copper(II) sulfate.

What happens during the reaction?

A The copper(II) sulfate turns blue and the solution formed gets colder.

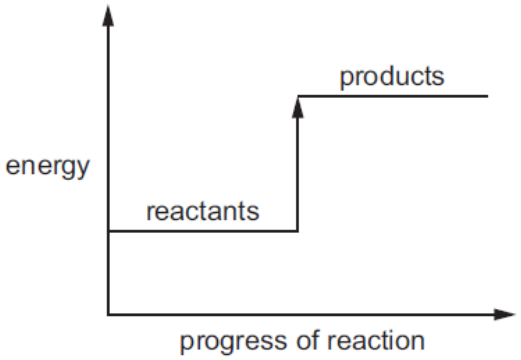
B The copper(II) sulfate turns blue and the solution formed gets hotter.

C The copper(II) sulfate turns white and the solution formed gets colder.

D The copper(II) sulfate turns white and the solution formed gets hotter.

5. June/2022/Paper_13/No.11

The energy level diagram for a reaction is shown.



Which statement is correct?

A The reaction is endothermic and heat energy is released.

B The reaction is endothermic and heat energy is taken in.

C The reaction is exothermic and heat energy is released.

D The reaction is exothermic and heat energy is taken in.

6. June/2022/Paper_13/No.15

Water is added to anhydrous copper(II) sulfate.

What happens during the reaction?

A The copper(II) sulfate turns blue and the solution formed gets colder.

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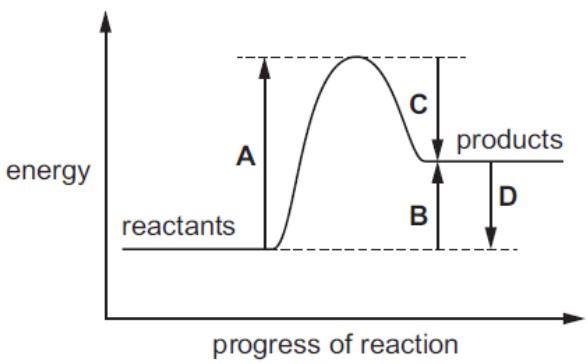
C The copper(II) sulfate turns white and the solution formed gets colder.

D The copper(II) sulfate turns white and the solution formed gets hotter.

7. June/2022/Paper_22/No.16

Which arrow on the energy level diagram shows the overall energy change for an endothermic reaction?



8. June/2022/Paper_22/No.17

When a hydrogen–oxygen fuel cell is in operation, a different reaction happens at each electrode.

at the hydrogen electrode $H_2 \rightarrow 2H^+ + 2e^-$

at the oxygen electrode $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

The electrons that are lost at the hydrogen electrode travel through the external circuit to the oxygen electrode, where they are gained by the oxygen and water.

A hydrogen–oxygen fuel cell is operated for a period of time and four moles of oxygen molecules are consumed.

Which mass of hydrogen is consumed?

A 2.0 g **B** 4.0 g **C** 8.0 g **D** 16.0 g

9. June/2022/Paper_23/No.11

Which statement about fuels is correct?

A Coal and ethanol are examples of non-renewable energy sources.

B Hydrogen and oxygen can be reacted to produce an electric current.

C Large amounts of energy are taken in by a fuel when it burns.

D Radioactive isotopes are burned to produce heat.

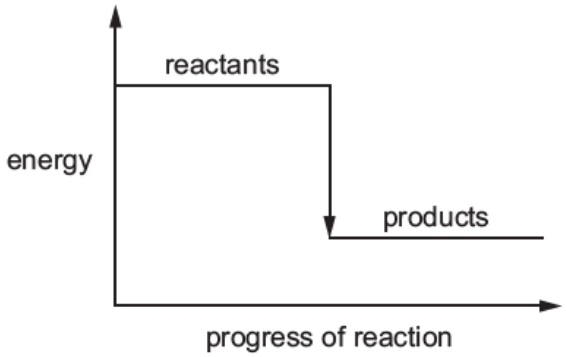
10. June/2022/Paper_31/No.4(d)

(d) The reaction of hydrochloric acid with calcium oxide is exothermic.

(i) State the meaning of the term *exothermic*.

..... [1]

(ii) The energy level diagram for the reaction of hydrochloric acid with calcium oxide is shown.



Explain how the energy level diagram shows that this reaction is exothermic.

.....

..... [1]

11. June/2022/Paper_32/No.4(d)

(d) When nitric acid reacts with calcium hydroxide, the temperature of the reaction mixture increases.

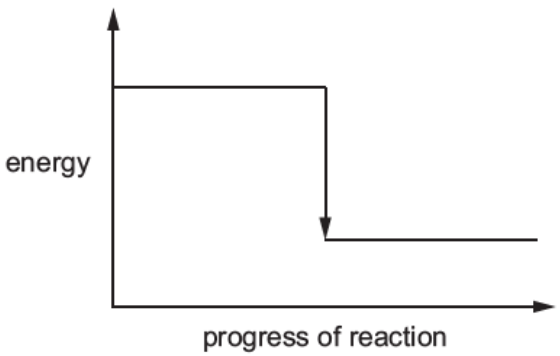
(i) Choose the word which best describes this reaction.

Draw a circle around your chosen answer.

decomposition **endothermic** **exothermic** **oxidation** [1]

(ii) Complete the energy level diagram for the reaction of nitric acid with calcium hydroxide by writing the words:

- reactants
- products.



[1]

12. June/2022/Paper_33/No.4(c)

(c) Calcium carbonate decomposes when heated.

calcium carbonate → calcium oxide + carbon dioxide

(i) Calcium carbonate is used in the manufacture of lime (calcium oxide).

State one **other** use of calcium carbonate.

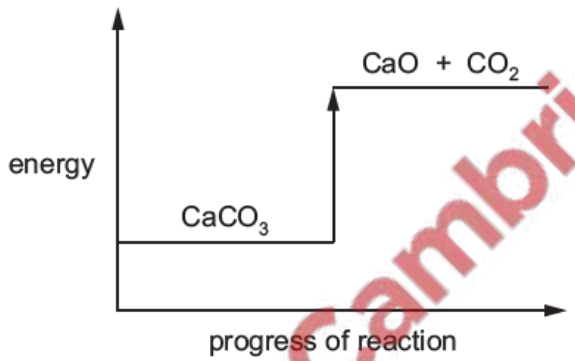
..... [1]

(ii) The decomposition of calcium carbonate is endothermic.

State the meaning of the term *endothermic*.

..... [1]

(iii) The energy level diagram for the decomposition of calcium carbonate is shown.



Explain how the energy level diagram shows that this reaction is endothermic.

.....

..... [1]

(iv) When 0.50 g of calcium carbonate decomposes, 120 cm^3 of carbon dioxide gas is produced.

Calculate the volume of carbon dioxide gas produced when 0.10 g of calcium carbonate is used.

volume of carbon dioxide gas = ... cm^3 [1]

13. June/2022/Paper_41/No.7(e)

(e) Ethanoic acid is a member of the homologous series of carboxylic acids.

State the general formula of this homologous series.

..... [1]

14. March/2022/Paper_12/No.15

Which row describes the changes that occur in an endothermic reaction?

	energy change	temperature
A	energy given out to the surroundings	decreases
B	energy given out to the surroundings	increases
C	energy taken in from the surroundings	decreases
D	energy taken in from the surroundings	increases

15. March/2022/Paper_12/No.16

Which statement about fuels is correct?

A Heat energy is only produced by burning fuels.

B Hydrogen is used as a fuel although it is difficult to store.

C Methane is a good fuel because it produces only water when burned.

D Uranium is burned in air to produce energy.

16. March/2022/Paper_22/No.15

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17. March/2022/Paper_22/No.16

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18. March/2022/Paper_22/No.17

Which statement about endothermic and exothermic reactions is correct?

A In an endothermic reaction, less energy is absorbed in bond breaking than is released in bond forming.

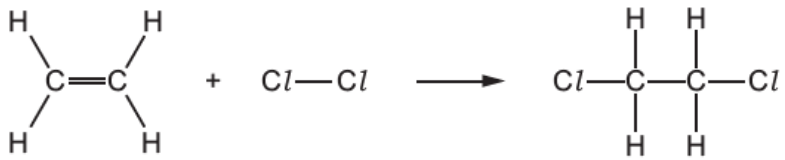
B In an endothermic reaction, the activation energy is always higher than in an exothermic reaction.

C In an exothermic reaction, more energy is absorbed in bond breaking than is released in bond forming.

D In an exothermic reaction, the reactants are higher on an energy level diagram than the products.

19. March/2022/Paper_43/No.5(c) (ii)

(ii) The chemical equation for this reaction can be represented as shown.



The energy change for the reaction is –180 kJ/mol.

Use the bond energies in the table to calculate the bond energy of a C–C*l* bond, in kJ/mol.

bond	C–H	C=C	C*l*–C*l*	C–C
bond energy in kJ/mol	410	610	240	350

Use the following steps.

step 1 Calculate the energy needed to break bonds.

energy needed to break bonds = ... kJ

step 2 Use your answer in **step 1** and the energy change for the reaction to determine the energy released when bonds are formed.

energy released when bonds form = ... kJ

step 3 Use your answer in **step 2** and bond energy values to determine the energy of a C–C*l* bond.

bond energy of a C–C*l* bond = ... kJ/mol

[4]