Anglo-Chinese School
(Barker Road)
A Methodist Institution
Founded in 1886

CHEMISTRY
DEPARTMENT OF SCIENCE

Name: ANSWERS ( ) Class: SEC 4

ENERGY CHANGES – ASSIGNMENT

Multiple-Choice Questions [20 Marks]

TOTAL SCORE / 30

Write in your selected answer for the multiple-choice questions in the boxes provided.

1	2	3	4	5	6	7	8	9	10
D	D	B	A	C	C	A	B	B	A

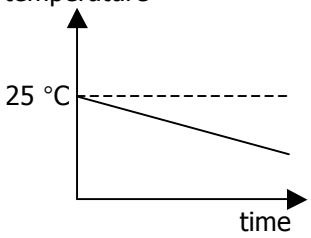
11	12	13	14	15	16	17	18	19	20
A	D	C	C	A	C	B	D	D	D

1. Which of the following statements about an exothermic reaction is **false**?

   A The enthalpy change of the reaction is negative.
   B The reactants have higher energy than the products.
   C The reaction vessel increases in temperature.
   D The speed of reaction is greatest under low temperatures.

2. The dissolving of calcium chloride in water is an exothermic process. Which of the following graphs most accurately shows how the temperature of the reaction vessel varies with time?

A



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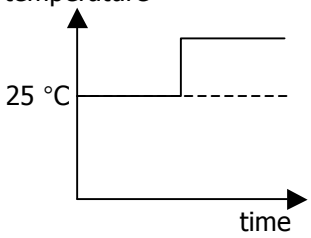

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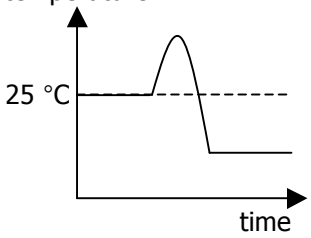

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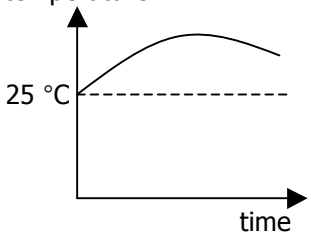


3. Which of the following processes is exothermic?

   A boiling of water
   B neutralisation
   C photosynthesis
   D thermal decomposition

4. An endothermic reaction occurs when

A ammonium chloride dissolves in water.
B sodium reacts with water.
C water at 0 °C changes to ice at 0 °C.
D water is formed from hydrogen and oxygen.

5. Which of the following is an endothermic process?

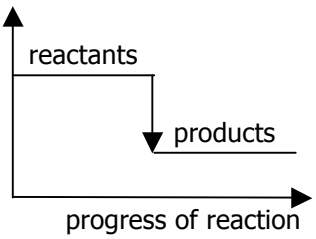
A The addition of water to anhydrous copper(II) sulfate.
B The combustion of ethanol in air.
C The formation of a carbohydrate and oxygen from carbon dioxide and water.
D The oxidation of carbon to carbon dioxide.

6. Which of the following is a difference between endothermic and exothermic reactions?

A Endothermic reactions have a negative enthalpy.
B In endothermic reactions, light is always absorbed.
C In exothermic reactions, bonds are formed.
D In exothermic reactions, heat is always absorbed.

7. Which energy diagram best represents an exothermic reaction?

A



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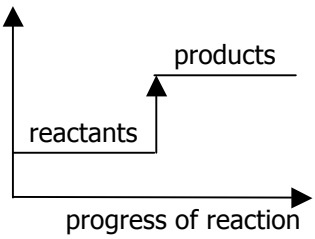

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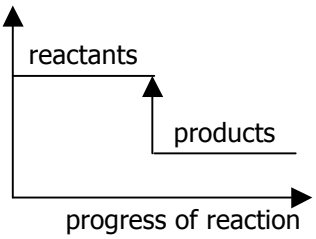

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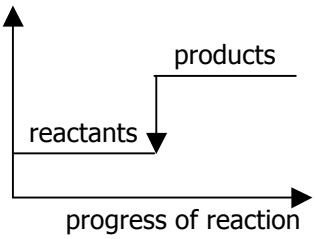


8. Which of the following statements is **not** true?

A All chemical reactions involve an energy change.
B Dissolving a salt in water is always an endothermic reaction.
C Exothermic reactions usually involve bond formation.
D When a chemical bond is broken, energy is absorbed.

9. Heat energy is given to the surroundings during

A boiling **B** condensation **C** evaporation **D** melting

10. The formation of liquid water from hydrogen and oxygen occurs in three stages:

Stage **I**: $2\ H_2\ (g) + O_2\ (g) \longrightarrow 4\ H\ (g) + 2\ O\ (g)$
Stage **II**: $4\ H\ (g) + 2\ O\ (g) \longrightarrow 2\ H_2O\ (g)$
Stage **III**: $2\ H_2O\ (g) \longrightarrow 2\ H_2O\ (l)$

Which stages are endothermic?

A Stage **I** only
B Stage **II** only
C Stages **I** and **III** only
D Stages **II** and **III** only

11. The reaction between hydrogen and iodine vapour is endothermic. In this reaction

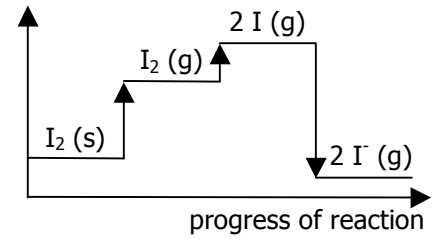
A temperature decreases and chemical energy is increased.
B temperature decreases and chemical energy is decreased.
C temperature increases and chemical energy is increased.
D temperature increases and chemical energy is decreases.

12. Observe the reactions occurring to a crystal of iodine below.

$$\mathbf{I_2\ (s) \longrightarrow I_2\ (g) \longrightarrow 2\ I\ (g) \longrightarrow 2\ I^-\ (g)}$$

Which of the following graphs best represents the energy level of the substances?

A



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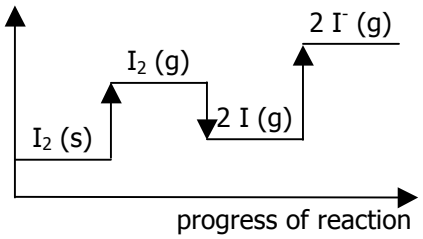

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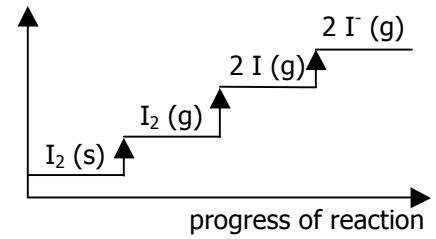

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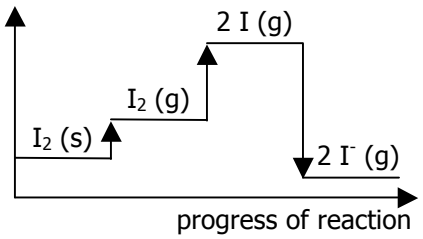

13. The table shows the energy released by the combustion of some compounds used as fuels.

compound	formula	ΔH (kJ/mol)
ethanol	C_2H_5OH	– 1380
heptane	C_7H_{16}	– 4800
methane	CH_4	– 880
propane	C_3H_8	– 2200

Which fuel provides the most energy when 100 g of the compound is completely burnt?

A ethanol **B** heptane **C** methane **D** propane

14. The equation for the extraction of iron in the blast furnace is given below. Which of the following has taken place when 1 mole of iron is produced in this reaction?

$$\mathbf{Fe_2O_3 + 3\ CO \longrightarrow 2\ Fe + 3\ CO_2 \quad \Delta H = -27.0\ kJ}$$

A 13.5 kJ of heat energy is absorbed.
B 27.0 kJ of heat energy is absorbed.
C 13.5 kJ of heat energy is given out.
D 27.0 kJ of heat energy is given out.

15. Which of the following reactions is endothermic?

A $CuCO_3\ (s) \longrightarrow CuO\ (s) + CO_2\ (g)$
B $Fe\ (s) + CuSO_4\ (aq) \longrightarrow FeSO_4\ (aq) + Cu\ (s)$
C $C_2H_5OH\ (aq) + 3\ O_2\ (g) \longrightarrow 2\ CO_2\ (g) + 3\ H_2O\ (g)$
D $2\ NaOH\ (aq) + H_2SO_4\ (aq) \longrightarrow Na_2SO_4\ (aq) + 2\ H_2O\ (l)$

16. In which of the following reactions would we expect an increase in chemical energy?

A $CO_2\ (g) \longrightarrow CO_2\ (s)$
B $Mg^{2+}\ (g) + 2\ e^- \longrightarrow Mg\ (g)$
C $N_2\ (g) \longrightarrow 2\ N\ (g)$
D $Ca(NO_3)_2\ (s) \longrightarrow Ca(NO_3)_2\ (aq)$

17. The formation of hydrogen iodide from hydrogen and iodine is an endothermic reaction. From this information, it may be deduced that:

A Hydrogen and iodine react more rapidly at room temperature than when heated.
B The energy change involved in bond forming is less than that involved in bond breaking.
C The number of bonds broken is greater than the number of bonds formed.
D The formation of H-I bonds absorbs energy.

18. Which of the following statements about exothermic reactions are correct?

(i) Energy is absorbed from the surroundings
(ii) Energy is released to the surroundings.
(iii) The temperature of the substances falls.
(iv) The temperature of the substances rises.

A (i) and (iii) only **B** (i) and (iv) only **C** (ii) and (iii) only **D** (ii) and (iv) only

19. When solid potassium nitrate is added to water, the temperature of the mixture falls. Which conclusion can be made from this observation?

A All solids dissolve with a fall in temperature.
B Aqueous potassium nitrate has less energy than solid potassium nitrate.
C Potassium nitrate is sparingly soluble in water.
D The solution of potassium nitrate is an endothermic reaction.

20. Hydrogen atoms are readily converted into hydrogen molecules. This reaction is

A endothermic, as bonds are broken.
B endothermic, as bonds are formed.
C exothermic, as bonds are broken.
D exothermic, as bonds are formed.

Structured Questions [10 Marks]

21. For each of the following types of reactions, explain its meaning and give an example of each.

(a) an 'exothermic' reaction [3]

Definition: It is a reaction which gives out energy, often in the form of heat, to the surroundings and may be detected by an increase in temperature.

Example: Neutralisation between sodium hydroxide and hydrochloric acid.

(b) an 'endothermic' reaction [3]

Definition: It is a reaction which takes in energy, often in the form of heat, from the surroundings and may be detected by a decrease in temperature.

Example: Dissolving of solid ammonium chloride in water

22. Aqueous calcium chloride was poured into a polystyrene cup. The initial temperature of the solution was 28.0 ^{o}C. Aqueous potassium carbonate was added. A white precipitate was formed and the thermometer registered a new temperature of 25.0 ^{o}C.

(a) Name the white precipitate [1]

Calcium carbonate

(b) Write the ionic equation to show the formation of the white precipitate. [1]

Ca^{2+} (aq) + CO_3^{2-} (aq) $\longrightarrow$ $CaCO_3$ (s)

(c) Was the formation of the white precipitate an endothermic or exothermic reaction? Explain how you derived your answer. [1]

Endothermic. The temperature of the reaction decreased from 28.0 °C to 25.0 °C.

(d) What was the function of the polystyrene cup? [1]

To act as an insulator to prevent excess heat from entering or leaving the reaction setup.

END