National
Qualifications
2018

X713/76/02

Chemistry
Section 1 — Questions

MONDAY, 21 MAY
9:00 AM – 11:30 AM

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X713/76/01.

Record your answers on the answer grid on *page 03* of your question and answer booklet.

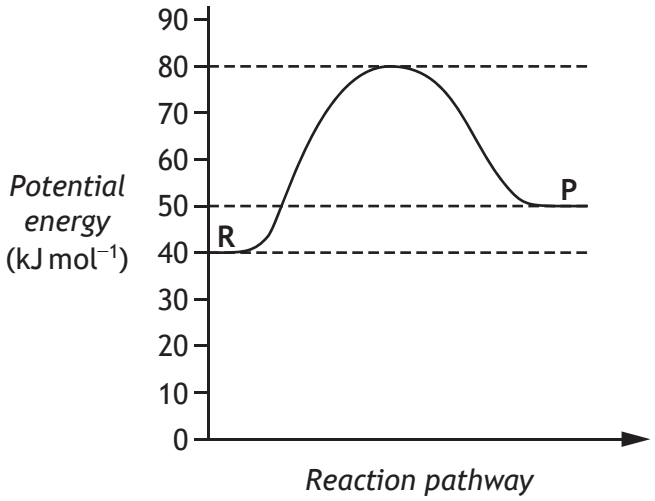
You may refer to the Chemistry Data Booklet for Higher and Advanced Higher.

Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SECTION 1 — 20 marks

Attempt ALL questions

1. The potential energy diagram below refers to the reversible reaction involving reactants **R** and products **P**.



What is the enthalpy change, in kJ mol^{-1}, for the **reverse** reaction?

A −40

B −10

C +10

D +30

2. The relative rate of a reaction which reached completion in 1 minute 40 seconds is

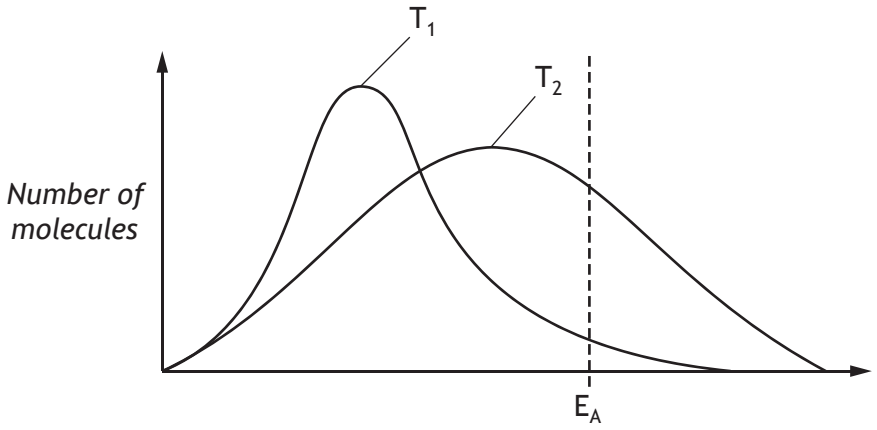
A 0·010 s^{-1}

B 0·714 s^{-1}

C 0·010 min^{-1}

D 0·714 min^{-1}.

3.



Which of the following is the correct interpretation of the above energy distribution diagram for a reaction as the temperature **decreases** from T_2 to T_1?

	Activation energy (E_A)	*Number of successful collisions*
A	remains the same	increases
B	decreases	decreases
C	decreases	increases
D	remains the same	decreases

4. The table shows the first three ionisation energies of aluminium.

Ionisation energy (kJ mol^{-1})		
First	*Second*	*Third*
578	1817	2745

Using this information, what is the enthalpy change, in kJ mol^{-1}, for the following reaction?

$$Al^{+}(g) \rightarrow Al^{3+}(g) + 2e^{-}$$

A 1817

B 2395

C 4562

D 5140

[Turn over

5. An element contains covalent bonding and London dispersion forces.

The element could be

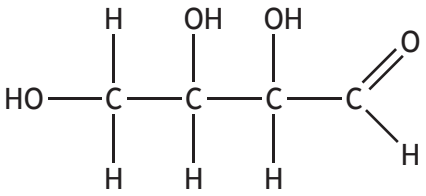
A boron

B neon

C sodium

D sulfur.

6. Erythrose is a chemical that is known to kill cancer cells.



erythrose

The two functional groups present in erythrose are

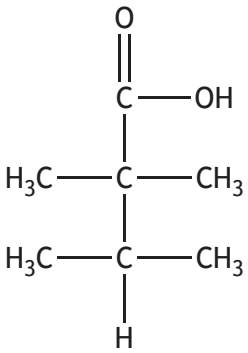
A carboxyl and ester

B carbonyl and ester

C carbonyl and hydroxyl

D carboxyl and hydroxyl.

7.



The name of the above compound is

A 2,2,3-trimethylbutanoic acid

B 2,3,3-trimethylbutanoic acid

C 1,1,2,2-tetramethylpropanoic acid

D 2,2,3,3-tetramethylpropanoic acid.

8. Which of the following is an isomer of pentan-3-ol?

A $CH_3CH_2CH(OH)CH_2CH_3$

B $CH_3CHCHCH_2CH_2OH$

C $CH_3CHCHCH(OH)CH_3$

D $CH_3CH(CH_3)CH_2CH_2OH$

9. Oxidation of 4-methylpentan-2-ol to the corresponding ketone results in the alcohol

A losing 2 g per mole

B gaining 2 g per mole

C losing 16 g per mole

D gaining 16 g per mole.

10. Essential amino acids are defined as the amino acids which

A are necessary for building proteins

B humans must acquire through their diet

C plants cannot synthesise for themselves

D are produced when any protein is hydrolysed.

11. A mixture of carbon monoxide and hydrogen can be converted into water and a mixture of hydrocarbons.

$\mathbf{n}\ CO + (\mathbf{2n} + \mathbf{1})\ H_2 \rightarrow \mathbf{n}\ H_2O +$ hydrocarbons

What is the general formula for the hydrocarbons produced?

A C_nH_{2n-2}

B C_nH_{2n}

C C_nH_{2n+1}

D C_nH_{2n+2}

12. A mixture of sodium chloride and sodium sulfate is known to contain 0·6 mol of chloride ions and 0·2 mol of sulfate ions.

How many moles of sodium ions are present?

A 0·4

B 0·5

C 0·8

D 1·0

13. Under the same conditions of temperature and pressure, which of the following gases would occupy the largest volume?

A 0·20 g of hydrogen

B 0·44 g of carbon dioxide

C 0·60 g of neon

D 0·80 g of argon

14. $3CuO + 2NH_3 \rightarrow 3Cu + N_2 + 3H_2O$

What volume of gas, in cm^3, would be obtained by reaction between 100 cm^3 of ammonia gas and excess copper(II) oxide?

All volumes are measured at atmospheric pressure and 20 °C.

A 50

B 100

C 200

D 400

15. $Cl_2(g) + H_2O(\ell) \rightleftharpoons Cl^-(aq) + ClO^-(aq) + 2H^+(aq)$

The addition of which of the following substances would move the above equilibrium to the right?

A Hydrogen

B Hydrogen chloride

C Sodium chloride

D Sodium hydroxide

16. When 3·6 g of butanal (mass of one mole = 72 g) was burned, 124 kJ of energy was released.

What is the enthalpy of combustion of butanal, in kJ mol^{-1}?

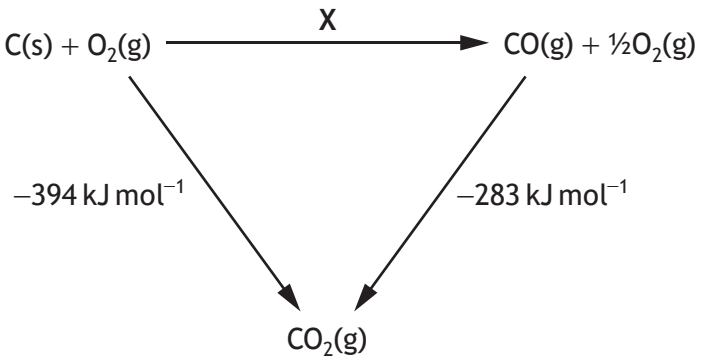
A −6·2

B +6·2

C −2480

D +2480

17. Consider the reaction pathways shown below.



According to Hess's Law, the enthalpy change, in kJ mol^{-1}, for reaction **X** is

A +111

B −111

C −677

D +677.

18. $SO_3^{2-}(aq) + H_2O(\ell) \rightarrow SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$

Which of the following ions could be used to oxidise sulfite ions to sulfate ions?

A $Cr^{3+}(aq)$

B $Al^{3+}(aq)$

C $Fe^{3+}(aq)$

D $Sn^{4+}(aq)$

19. During a redox reaction nitrate ions, NO_3^-, are converted to nitrogen monoxide, NO.

$$NO_3^- \rightarrow NO$$

Which line in the table correctly completes the ion-electron equation?

	Reactants	*Products*
A	$6H^+ + 5e^-$	$3H_2O$
B	$4H^+ + 3e^-$	$2H_2O$
C	$6H^+$	$3H_2O + 5e^-$
D	$4H^+$	$2H_2O + 3e^-$

20. $ICl(\ell) + Cl_2(g) \rightleftharpoons ICl_3(s) \quad \Delta H = -106 kJ\,mol^{-1}$

Which line in the table identifies correctly the changes that will cause the greatest increase in the proportion of solid in the above equilibrium mixture?

	Temperature	*Pressure*
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET.]