National
Qualifications
2019

X813/76/12

Chemistry
Paper 1 — Multiple choice

FRIDAY, 10 MAY
9:00 AM – 9:40 AM

Total marks — 25

Attempt ALL questions.

You may use a calculator.

Instructions for the completion of Paper 1 are given on *page 02* of your answer booklet X813/76/02.

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

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

Space for rough work is provided at the end of this booklet.

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

Total marks — 25

Attempt ALL questions

1. Hydrogen will form a non-polar covalent bond with an element that has an electronegativity value of

A 0·9

B 1·5

C 2·2

D 2·5.

2. Which of the following is a polar molecule?

A CCl_4

B NH_3

C CO_2

D CH_4

3. Which of the following is most likely to act as a reducing agent?

A CO

B MnO_4^-

C H_2O_2

D $Cr_2O_7^{2-}$

4. The following reactions take place when nitric acid is added to zinc.

$$NO_3^-(aq) + 4H^+(aq) + 3e^- \rightarrow NO(g) + 2H_2O(\ell)$$

$$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$$

How many moles of Zn(s) are oxidised by one mole of NO_3^- (aq)?

A 0·67

B 1·0

C 1·5

D 2·0

5. Which of the following compounds is a tertiary alcohol?

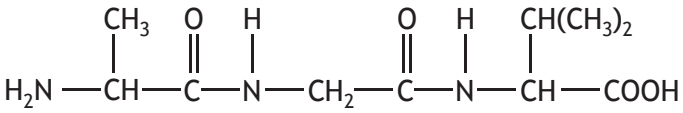
A 2,2-dimethylpropan-1-ol

B 2-methylbutan-2-ol

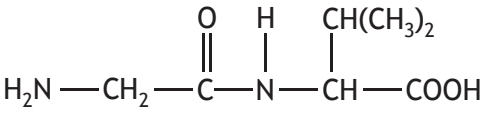
C pentan-3-ol

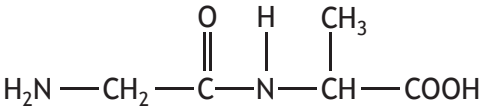
D 3-methylbutan-2-ol

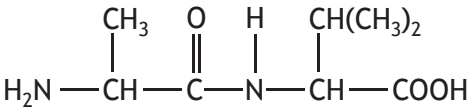
6. Molecule **X** has the structure

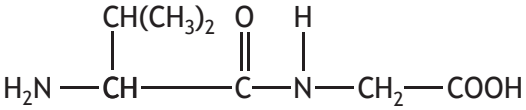


Which of the following could be produced by partial hydrolysis of **X**?

A 

B 

C 

D 

7. A compound with molecular formula $C_6H_{12}O_2$ could be

A pentyl ethanoate

B hexan-2-one

C 3-methylpentan-2-ol

D hexanoic acid.

[Turn over

8. Compound X reacted with hot copper(II) oxide and the resulting product did **not** give a colour change when heated with Fehling's solution.

Compound X could be

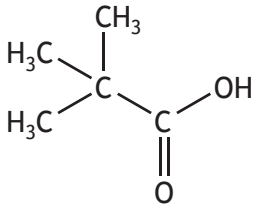
A pentan-1-ol

B pentan-2-ol

C pentan-3-one

D pentanoic acid.

9. The structure of pivalic acid is shown.



Which of the following is the correct systematic name of pivalic acid?

A pentanoic acid

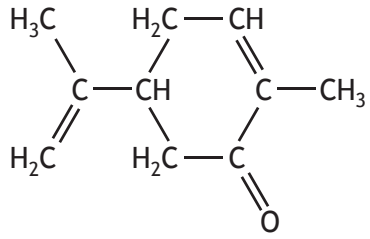
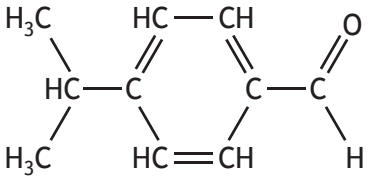
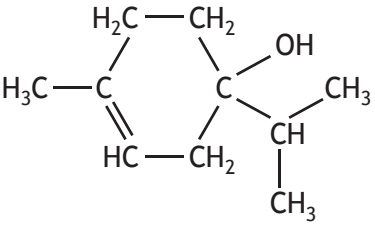
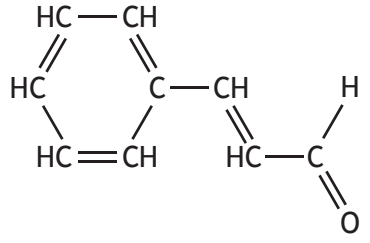
B 2,2,2-trimethylethanoic acid

C 2-ethylpropanoic acid

D 2,2-dimethylpropanoic acid

10. The table shows four compounds that contribute to the aroma of spices.

Which compound is **not** derived from a terpene?

	Structural formula	Molecular formula
A		$C_{10}H_{14}O$
B		$C_{10}H_{12}O$
C		$C_{10}H_{18}O$
D		C_9H_8O

11. Which reaction can be classified as reduction?

A methanol → methanoic acid

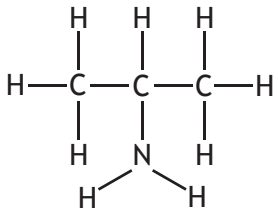
B propanal → propanoic acid

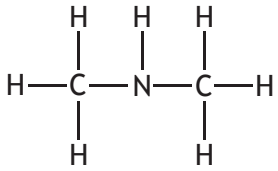
C butan-2-one → butan-2-ol

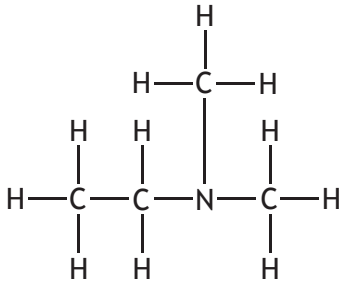
D propan-2-ol → propanone

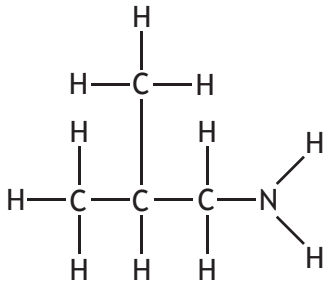
[Turn over

12. A secondary amine has two carbon atoms directly bonded to the nitrogen atom.
Which of the following is a secondary amine?

A 

B 

C 

D 

13. The number of moles of ions in 1 mol of copper(II) phosphate is

A 1

B 2

C 3

D 5.

14. Which of the following gas samples has the same volume as 4·0 g of methane, CH_4?
(All volumes are measured at the same temperature and pressure.)

A 1·0 g of helium
B 1·0 g of hydrogen
C 3·5 g of nitrogen
D 35·5 g of chlorine

15. Magnesium carbonate reacts with nitric acid.

$MgCO_3(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2O(\ell) + CO_2(g)$

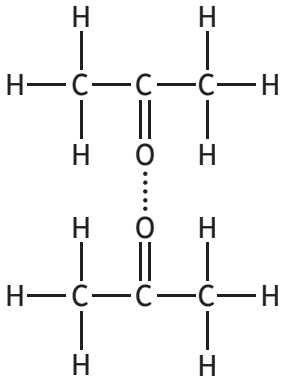
0·05 mol of magnesium carbonate was added to a solution containing 0·06 mol of nitric acid.
Which of the following statements is true?

A 0·05 mol of carbon dioxide is produced
B 0·06 mol of magnesium nitrate is produced
C Magnesium carbonate is in excess by 0·02 mol
D Nitric acid is in excess by 0·01 mol

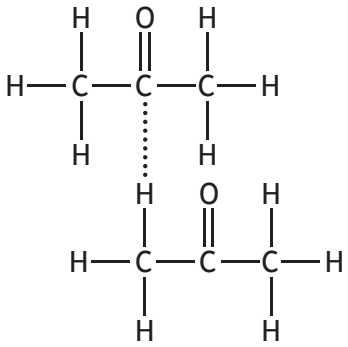
[Turn over

16. In which of the following diagrams does the dotted line represent a permanent dipole-permanent dipole interaction between propanone molecules?

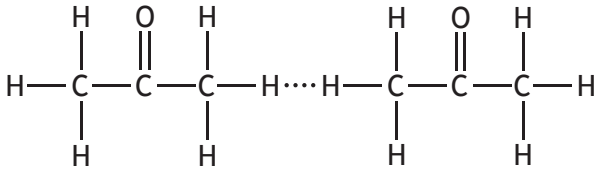
A



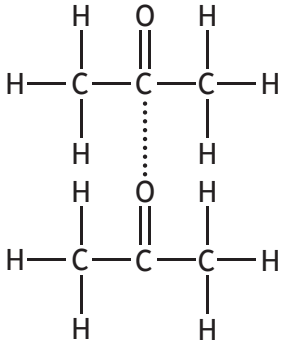
B



C



D



17. Iron can be produced from iron(III) oxide.

$$\underset{\text{GFM} = 159{\cdot}6\text{ g}}{2Fe_2O_3(s)} + \underset{\text{GFM} = 12{\cdot}0\text{ g}}{3C(s)} \rightarrow \underset{\text{GFM} = 55{\cdot}8\text{ g}}{4Fe(s)} + \underset{\text{GFM} = 44{\cdot}0\text{ g}}{3CO_2(g)}$$

The atom economy for the production of iron is

A 69·9%
B 62·8%
C 58·2%
D 32·5%.

18. 100 cm^3 of propane is mixed with 600 cm^3 of oxygen and the mixture is ignited.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(\ell)$$

At the end of the reaction, the total volume of gas would be

A 300 cm^3
B 400 cm^3
C 700 cm^3
D 800 cm^3.

19. A two-step reaction is shown below.

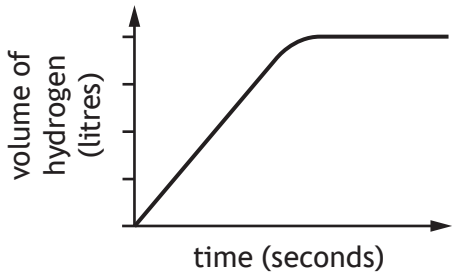
$$A \xrightarrow[\text{step 1}]{} B \xrightarrow[\text{step 2}]{} C$$

The first step gave a yield of 60% and the second step a yield of 90%.
The overall yield would be

A 30%
B 54%
C 67%
D 150%.

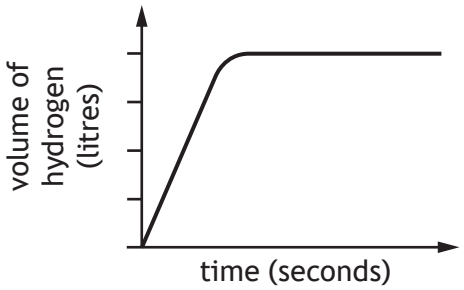
[Turn over

20. The volume of hydrogen gas given off against time when an excess of zinc lumps is added to 100 cm^3 of 1 mol l^{-1} hydrochloric acid is shown.

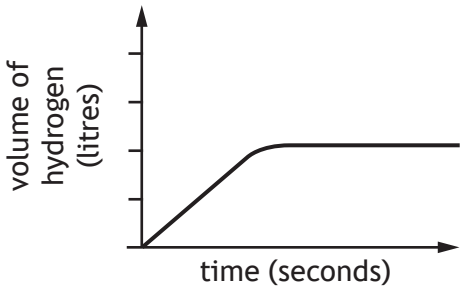


Which of the following graphs would show the volume of hydrogen gas given off when an excess of zinc powder was added to 50 cm^3 of 1 mol l^{-1} hydrochloric acid?

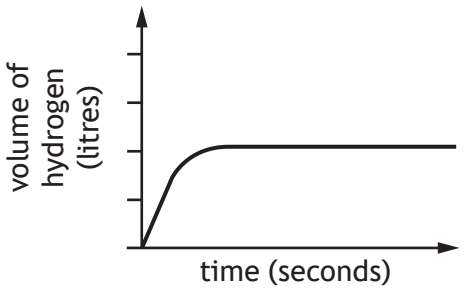
A



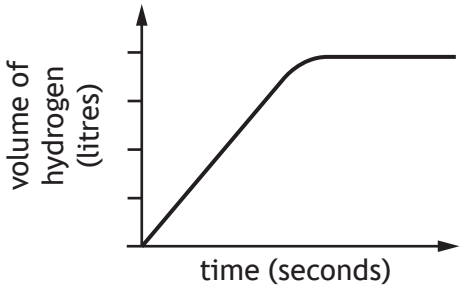
B



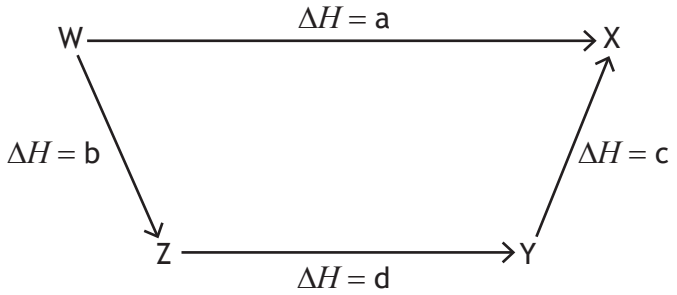
C



D



21. Consider the reaction pathway shown below.



According to Hess's Law

A $b = a - c - d$

B $b = a + c + d$

C $b = d - c + a$

D $b = d + c - a$.

22. Which of the following is **not** a factor that affects the rate of a reaction?

A Activation energy

B Kinetic energies of reactant molecules

C Concentration of reactants

D Enthalpy change of reaction

23. In which of the following reactions would the yield of product be increased by lowering the pressure?

A $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

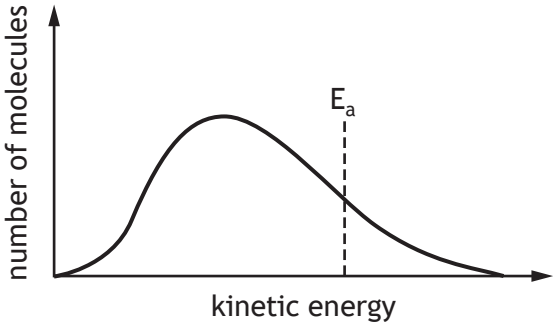
B $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

C $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

D $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$

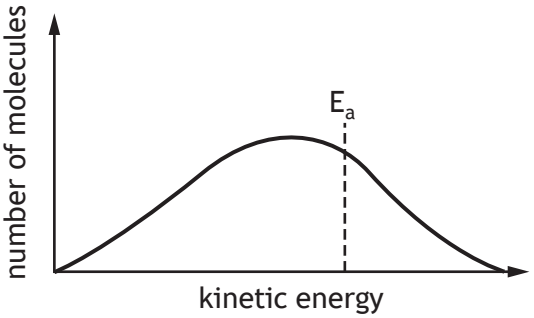
[Turn over

24. The graph shows the distribution of kinetic energies for a reaction involving two gases.

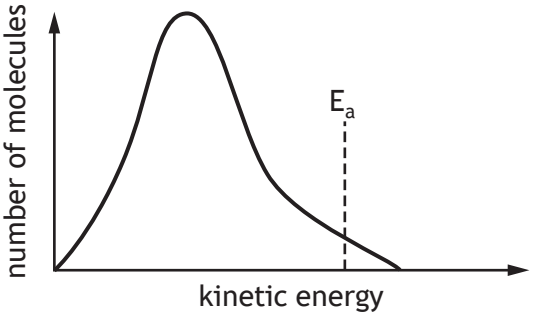


Which graph would show the effect of increasing temperature?

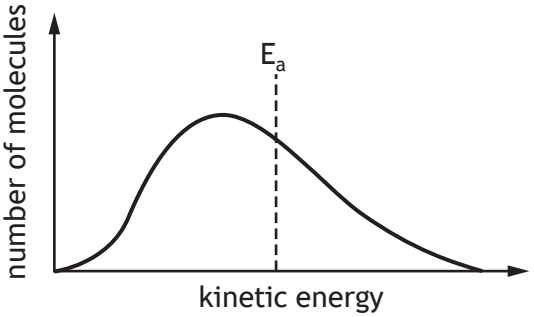
A



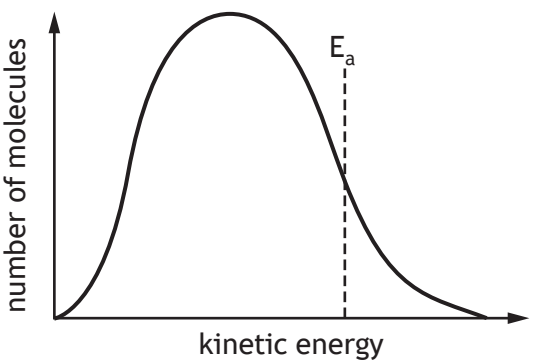
B



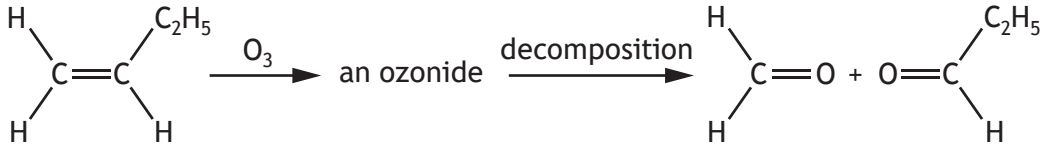
C



D



25. Alkenes react with ozone, O_3, to form ozonides which can be decomposed to give carbonyl compounds.



Which of the following alkenes would produce a mixture of ethanal and propanone?

A $CH_3CH=CHCH_2CH_3$

B $CH_3CH=CHCH_3$

C $CH_3C(CH_3)=CH_2$

D $CH_3CH=C(CH_3)CH_3$

[END OF QUESTION PAPER]

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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