National
Qualifications
2025

X813/76/12

Chemistry
Paper 1 — Multiple choice

THURSDAY, 1 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. Which of the following is a pure covalent bond?

A N–Br
B H–Cl
C O–H
D C–I

2. Elements which are strong reducing agents

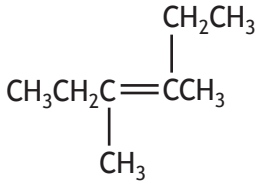
A undergo reduction reactions
B are found on the right-hand side of the periodic table
C have low electronegativity values
D tend to form ions by gaining electrons.

3. $MnO_4^-(aq) + 5Fe^{2+}(aq) + 8H^+(aq) \rightarrow Mn^{2+}(aq) + 5Fe^{3+}(aq) + 4H_2O(\ell)$

How many moles of Fe^{2+} are required to react with 100 cm^3 of 0.5 mol l^{-1} $KMnO_4$ solution?

A 0.05
B 0.25
C 2.5
D 5

4. Which of the following is the correct systematic name for the structure shown?



A 2,3-diethylbut-2-ene
B 2-ethyl-3-methylpent-2-ene
C 4-ethyl-3-methylpent-3-ene
D 3,4-dimethylhex-3-ene

5. Which of the following is a tertiary alcohol?

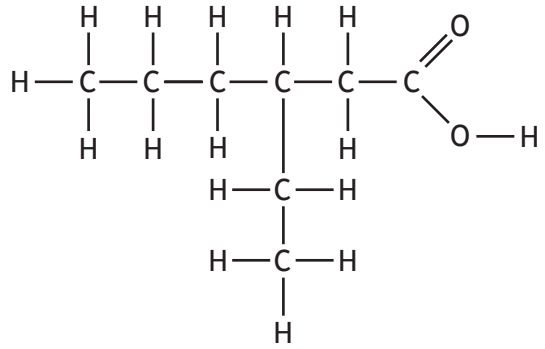
A 2-methylpentan-1-ol

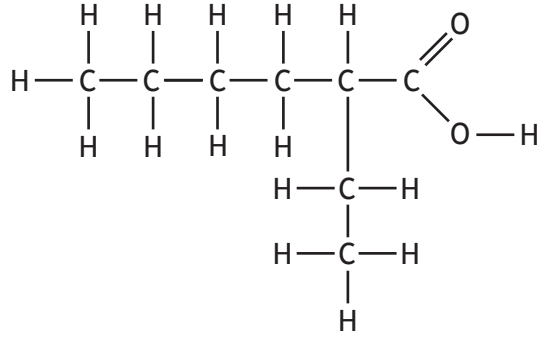
B 2-methylpentan-2-ol

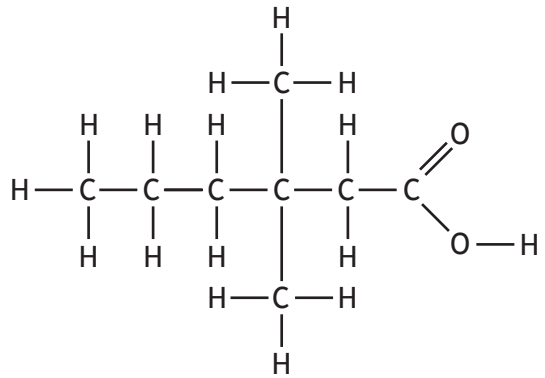
C 2-methylpentan-3-ol

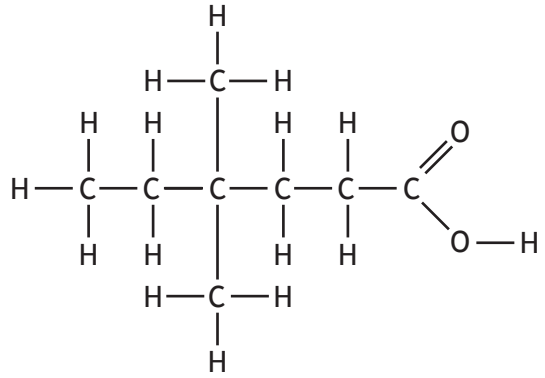
D 4-methylpentan-2-ol

6. Which of the following is the structure of 3-ethylhexanoic acid?

A 

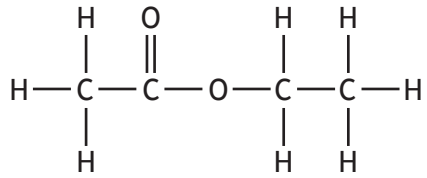
B 

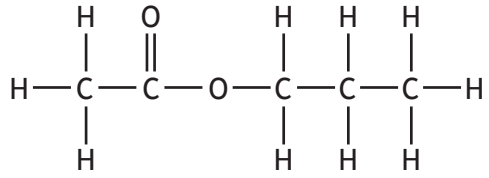
C 

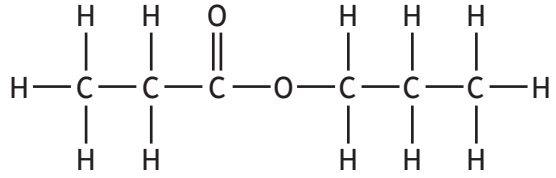
D 

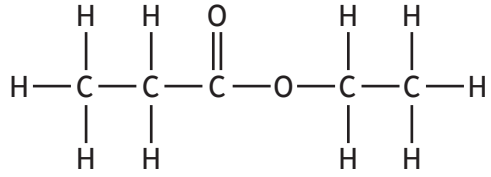
7. Hydrolysis of an ester gave an alcohol and a carboxylic acid, both of which had a gram formula mass of 60 g.

Which of the following is the structure of the ester?

A 

B 

C 

D 

8. What is the change in mass, in g, when one mole of butanal undergoes reduction?

A −16

B +16

C −2

D +2

9. 6-methylhept-5-ene-2-one is found in the sweat of some humans.

Which of the following is the correct formula for 6-methylhept-5-ene-2-one?

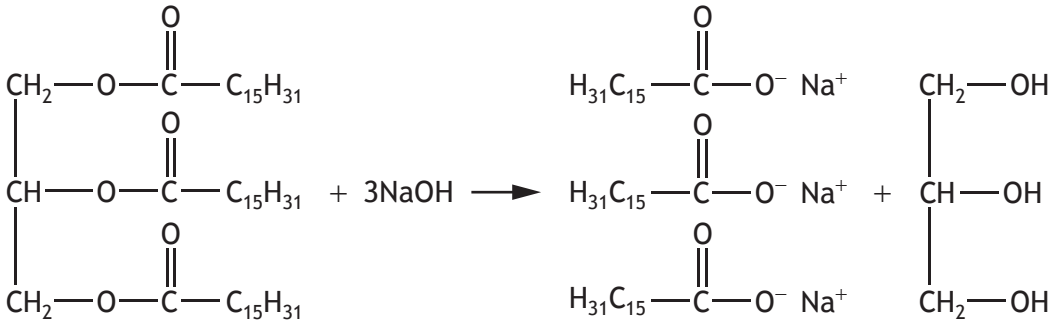
A $CH_3C(CH_3)CHCOCH_2CH_3$

B $CH_3CH(CH_3)CH_2CH_2CH_2COCH_3$

C $CH_3C(CH_3)CHCH_2CH_2COCH_3$

D $CH_3CH_2C(CH_3)CHCH_2COCH_3$

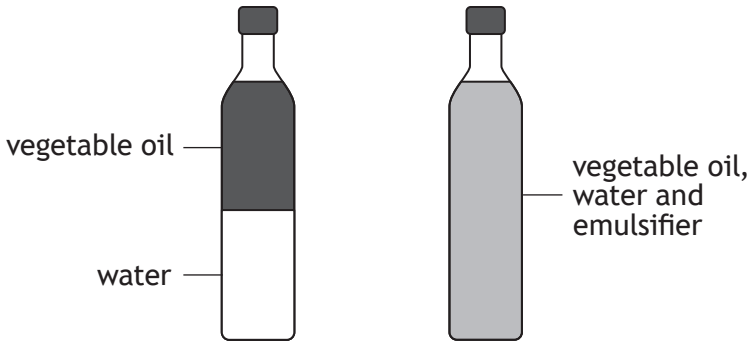
10. Saponification is the chemical reaction between edible fats and sodium hydroxide to produce soaps.



This reaction is an example of

A hydration
B hydrolysis
C esterification
D condensation.

11. An emulsion can be formed by shaking vegetable oil and water with an emulsifier.



In the emulsion formed, the fatty acid chains of the emulsifier are

A hydrophilic and dissolve in water
B hydrophobic and dissolve in water
C hydrophilic and dissolve in vegetable oil droplets
D hydrophobic and dissolve in vegetable oil droplets.

[Turn over

12. Which of the following is a terpene?

A $C_{13}H_{20}$

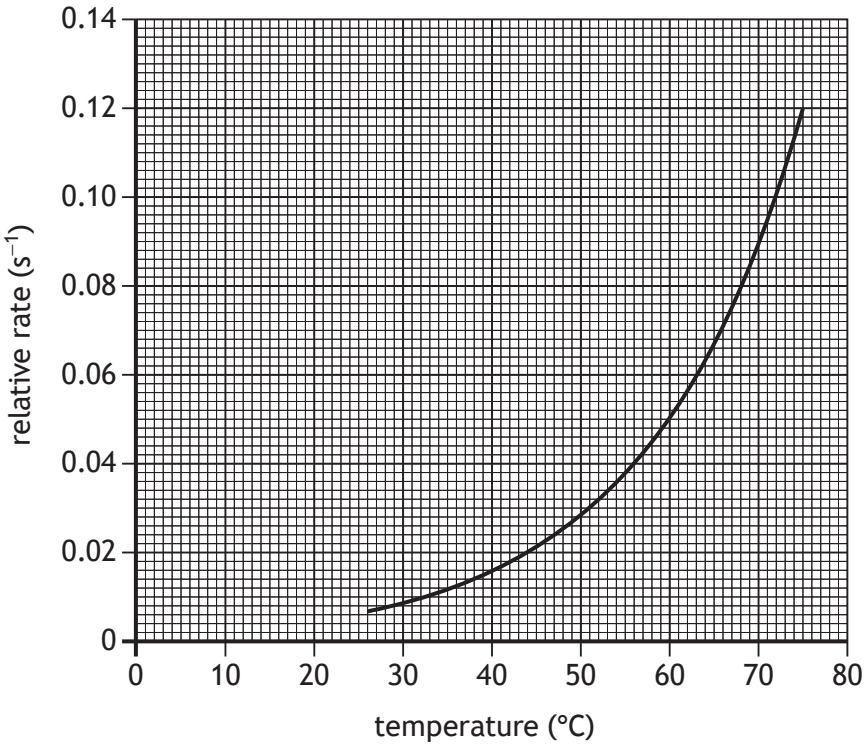
B $C_{15}H_{24}$

C $C_{17}H_{28}$

D $C_{19}H_{32}$

13. An investigation was carried out to determine the effect of changing temperature on the rate of a reaction.

The results from the investigation are shown in the graph.



Use the graph to determine the temperature rise, in °C, required to double the rate of the reaction.

A 0.04

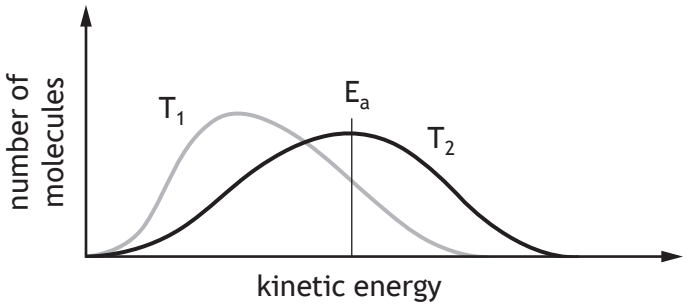
B 10

C 12

D 25

14. Which of the following diagrams shows the distribution of kinetic energies for the molecules of a reaction when the temperature of the reaction is increased from T_1 to T_2?

A



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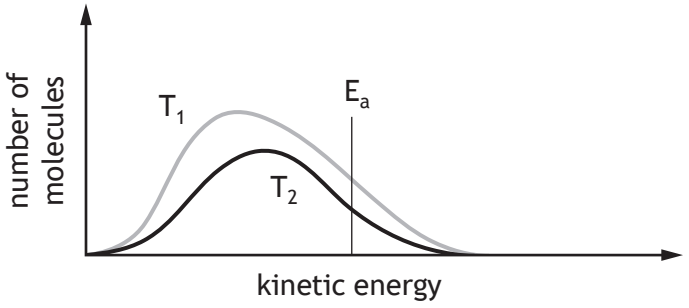
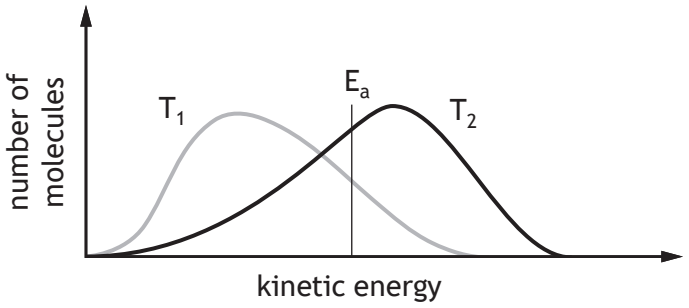
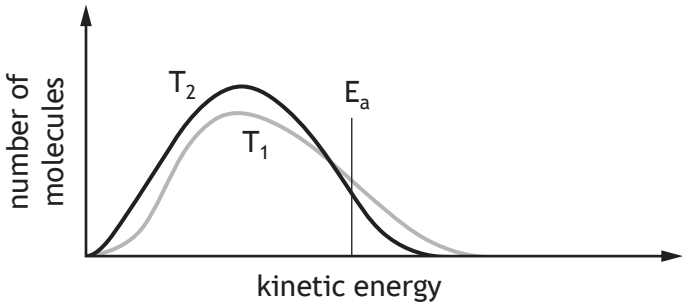


C



D



[Turn over

15. Some energy values associated with a chemical reaction are shown in the table.

Activation energy of forward reaction ($kJ\,mol^{-1}$)	Activation energy of reverse reaction ($kJ\,mol^{-1}$)
165	179

What is the enthalpy change for the forward reaction?

A −14 kJ

B +14 kJ

C −344 kJ

D +344 kJ

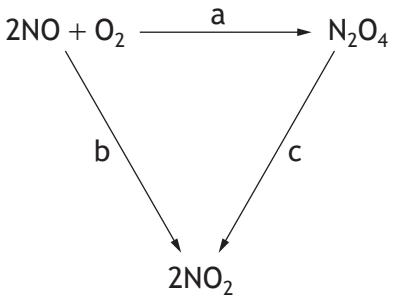
16. The equation for a reaction at equilibrium is shown.

$$A \rightleftharpoons B \qquad \Delta H = -100\ kJ\,mol^{-1}$$

Which of the following conditions will favour the formation of B?

	Reaction temperature	Activation energy of the forward reaction
A	high	low
B	low	high
C	high	high
D	low	low

17. Consider the reaction pathway shown.



What is the relationship between a, b and c?

A $c = a + b$

B $c = a - b$

C $c = -a - b$

D $c = -a + b$

18. According to Hess's law, which row in the table shows how equations **1** and **2** should be manipulated to calculate the enthalpy change for equation **3**?

Equation **1** $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(\ell)$

Equation **2** $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

Equation **3** $2CH_4(g) + 3O_2(g) \rightarrow 2CO(g) + 4H_2O(\ell)$

	Equation 1	**Equation 2**
A	unchanged	unchanged
B	multiplied by 2	reversed
C	unchanged	reversed
D	multiplied by 2	unchanged

19. Which of the following is a correct statement about a catalyst in a reaction?

A It increases the activation energy.

B It decreases the kinetic energy of reactant particles.

C It shifts the equilibrium to the right.

D It has no effect on the enthalpy change.

20. A two-step reaction is shown below.

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

Step 1 gave a yield of 50%. The overall yield of product C was 40%.

The yield for step 2 would be

A 10%

B 20%

C 80%

D 90%

[Turn over

21. A mixture of aluminium phosphate and aluminium sulfate is known to contain 5 moles of aluminium ions and 1 mole of phosphate ions.

How many moles of sulfate ions are present?

A 1

B 2

C 4

D 6

22. The electron affinity of an element is the energy change when one mole of gaseous atoms combines with one mole of electrons to form one mole of gaseous ions.

Which of the following equations represents the electron affinity of chlorine?

A $Cl(g) + e^- \rightarrow Cl^-(g)$

B $\frac{1}{2}Cl_2(g) + e^- \rightarrow Cl^-(g)$

C $\frac{1}{2}Cl_2(g) \rightarrow Cl^+(g) + e^-$

D $Cl(g) \rightarrow Cl^+(g) + e^-$

23. The following equilibrium exists in bromine solution.

$$\underset{\text{(red)}}{Br_2(aq)} + H_2O(\ell) \rightleftharpoons \underset{\text{(colourless)}}{Br^-(aq)} + 2H^+(aq) + \underset{\text{(colourless)}}{OBr^-(aq)}$$

The red colour of the solution would **fade** on adding a few drops of a concentrated solution of

A HCl

B KBr

C $AgNO_3$

D NaOBr.

24. When carrying out a titration to determine the mass of vitamin C in a tablet, which of the following will **not** help determine the end-point of the titration accurately?

A Adding the solution dropwise near the end-point.

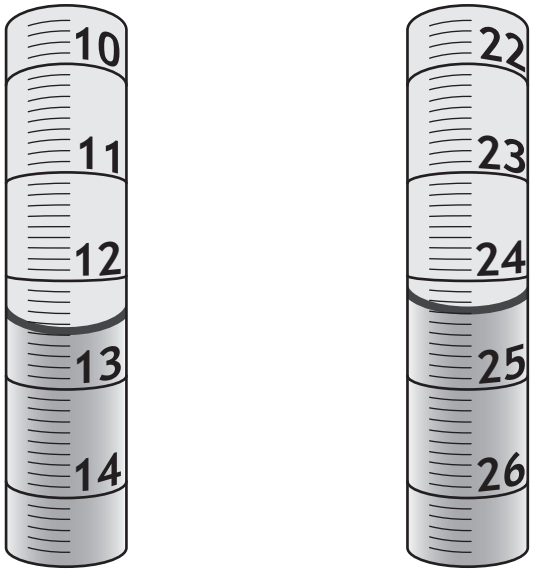
B Using a white tile below the conical flask.

C Using a dry conical flask.

D Swirling the flask.

25. A burette was used to carry out a titration.

The diagrams show the burette at the start and end of the titration.



start end

What volume of solution was added from the burette?

A 11.8 cm^3

B 12.2 cm^3

C 12.5 cm^3

D 24.3 cm^3

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