National
Qualifications
2023

X813/76/12

Chemistry
Paper 1 — Multiple choice

FRIDAY, 12 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.

X8137612

Total marks — 25

Attempt ALL questions

1. Which of the following compounds has the least ionic character?

A Sodium iodide

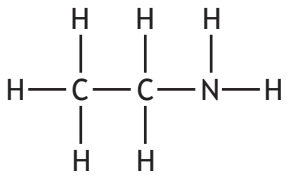
B Sodium fluoride

C Potassium iodide

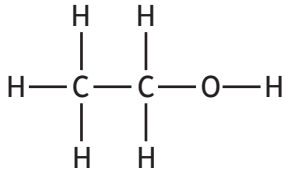
D Potassium fluoride

2. In which of the following compounds would hydrogen bonding **not** occur?

A



B



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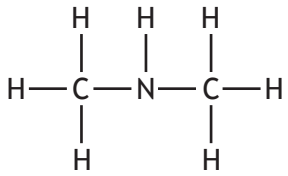
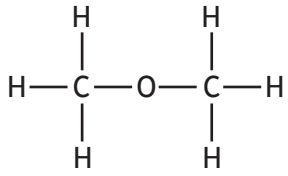


D



3. Fats are formed from glycerol molecules and fatty acid molecules.
The mole ratio of glycerol molecules to fatty acid molecules is

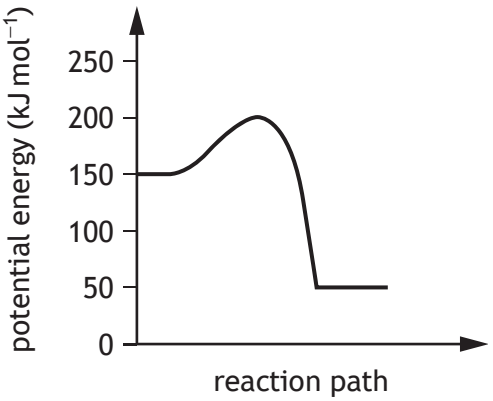
A 1 : 2

B 2 : 1

C 1 : 3

D 3 : 1

4. A reaction was carried out as shown in the energy diagram.



Which of the following has a value of 150 kJ mol^{-1}?

A Activation energy of the reverse reaction

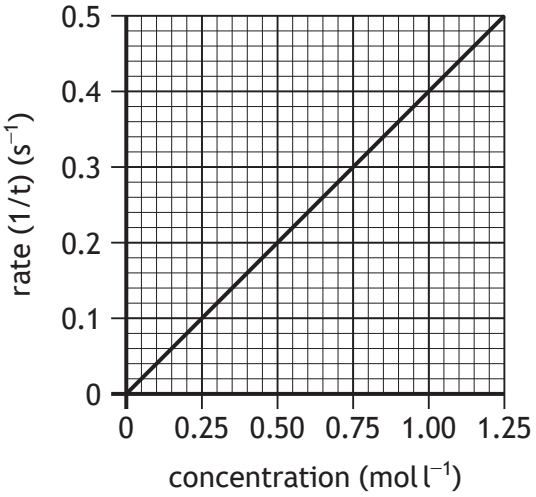
B Enthalpy change of the reverse reaction

C Activation energy of the forward reaction

D Enthalpy change of the forward reaction

[Turn over

5. The graph shows how the rate of a reaction varies with the concentration of one of the reactants.



What was the concentration, in mol l^{-1}, when the reaction time was 10 s?

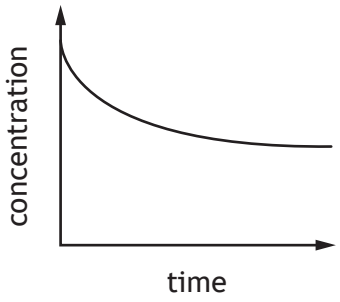
A 0.04

B 0.10

C 0.25

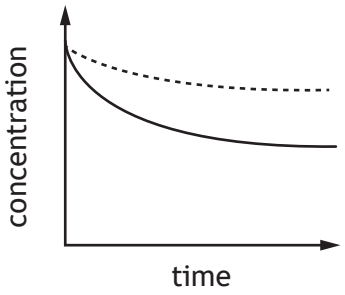
D 0.40

6. The diagram represents the change in concentration of a reactant against time during a reversible chemical reaction.

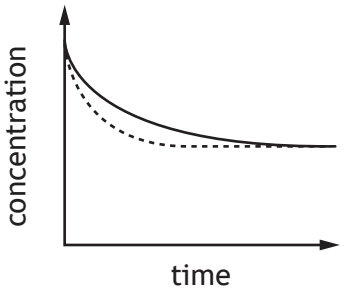


In which diagram below does the dotted line show the result of repeating the reaction using a catalyst?

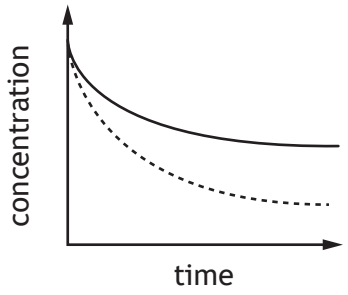
A



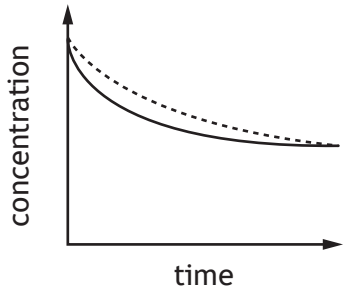
B



C



D



[Turn over

7. The enthalpy of combustion of methanol ($GFM = 32.0$ g) is -726 kJ mol^{-1}.
What mass of methanol has to be burned to produce 145.2 kJ?

A 3.2 g
B 6.4 g
C 32.0 g
D 160.0 g

8. Which of the following statements is true?

A The sodium atom is larger than the sodium ion.
B The chloride ion is smaller than the chlorine atom.
C The magnesium ion is larger than the magnesium atom.
D The oxygen atom is larger than the oxide ion.

9. Which of the following structures is **never** found in compounds?

A Covalent molecular
B Covalent network
C Monatomic
D Ionic

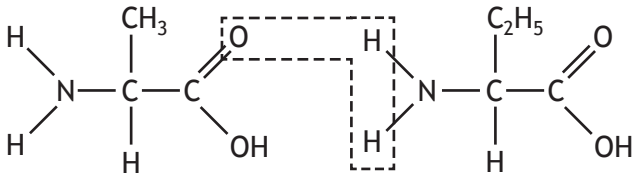
10. Which of the following carbon containing compounds is an isomer of hexanal?

A 2-methylbutanal
B 3-methylpentan-2-one
C 2,2-dimethylbutan-1-ol
D 3,3-dimethylpentanal

11. When two amino acids react in a condensation reaction, water is eliminated and a peptide link is formed.

Which of the following represents this process?

A



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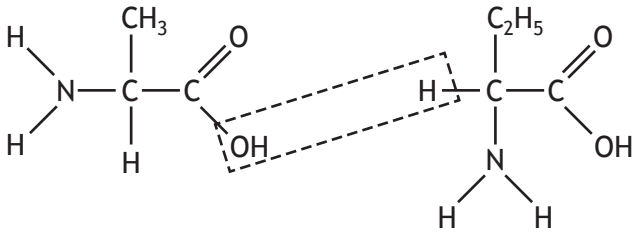

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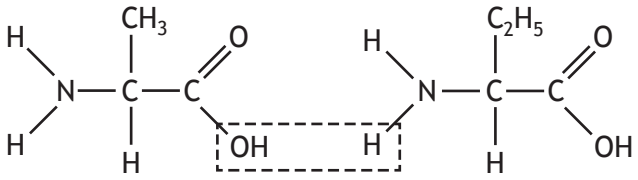

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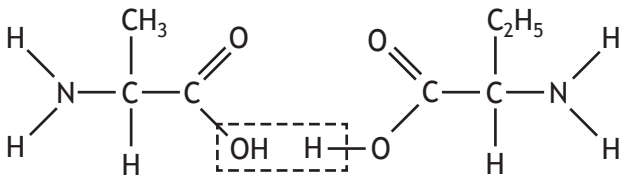


[Turn over

12. Which of the following equations represents an enthalpy of combustion?

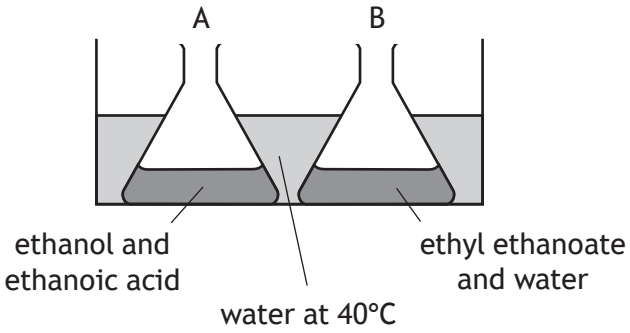
A $2CH_4(g) + 3O_2(g) \rightarrow 2CO(g) + 4H_2O(\ell)$

B $CH_4(g) + 1\frac{1}{2}O_2(g) \rightarrow CO(g) + 2H_2O(\ell)$

C $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(\ell)$

D $C_2H_6(g) + 3\frac{1}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(\ell)$

13. Two flasks, A and B, were placed in a water bath at 40°C.



After several days, the contents of the flasks were analysed.

Which results would be expected?

A Flask A contains ethyl ethanoate, water, ethanol and ethanoic acid; flask B is unchanged.

B Flask A contains only ethyl ethanoate and water; flask B is unchanged.

C Flask A contains only ethyl ethanoate and water; flask B contains only ethanol and ethanoic acid.

D Flask A and flask B contain ethyl ethanoate, water, ethanol and ethanoic acid.

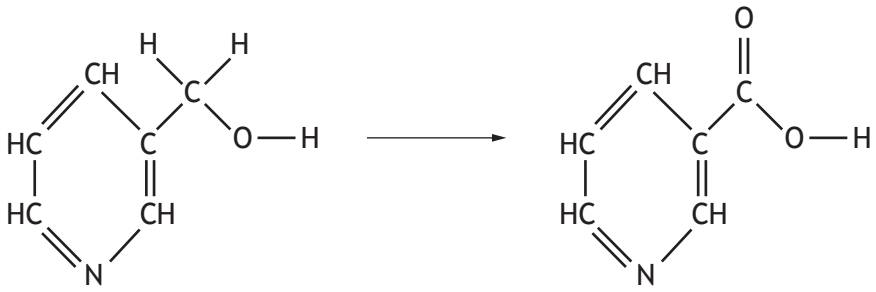
14. During a redox process in acid solution, iodate ions are converted into iodine.

$$2IO_3^-(aq) + 12H^+(aq) + xe^- \rightarrow I_2(aq) + 6H_2O(\ell)$$

What value of ***x*** is required to balance the equation?

A 12
B 11
C 10
D 6

15. A step in the synthesis of vitamin B_3 is shown.



What name is given to this type of reaction?

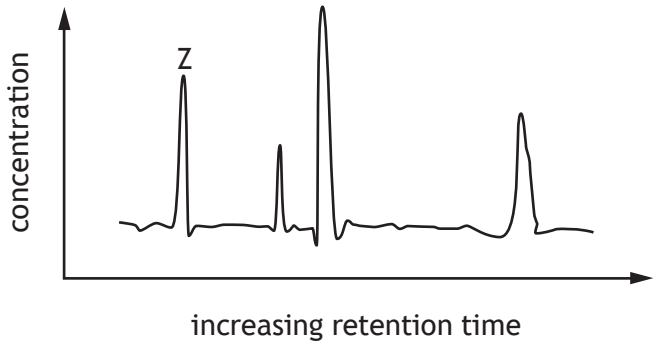
A Condensation
B Hydration
C Reduction
D Oxidation

[Turn over

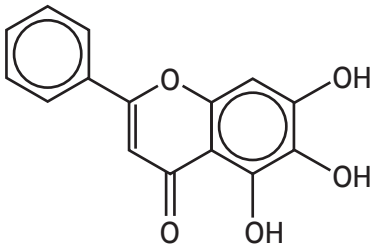
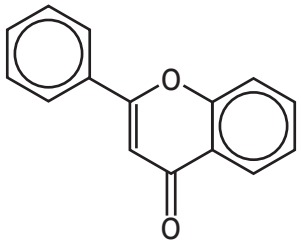
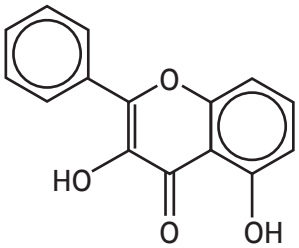
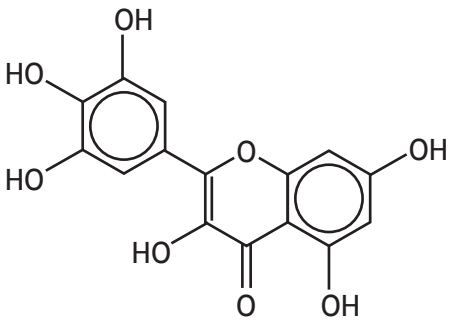
16. A chemist analysed a mixture of four dyes, A, B, C and D, using gas-liquid chromatography.

The time taken to travel through the column (retention time) depends on the polarity of the molecule. The more polar the molecule the longer the retention time.

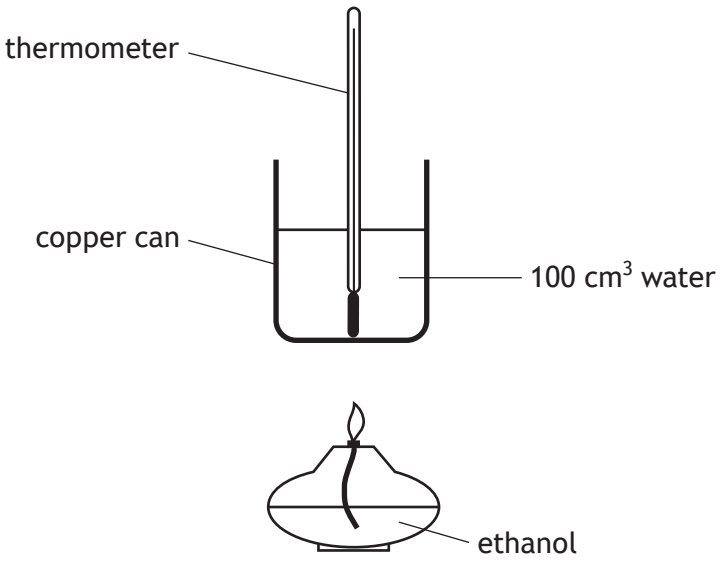
The following chromatogram was obtained.



Which of the following compounds corresponds to peak Z?

Dye	Structure
A	
B	
C	
D	

17. The apparatus was used to measure the enthalpy of combustion of ethanol.



Which of the following would **not** improve the accuracy of the result?

A Using a draught shield

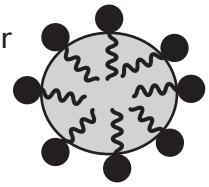
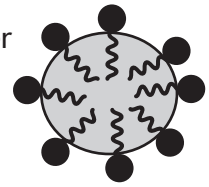
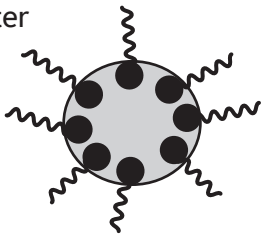
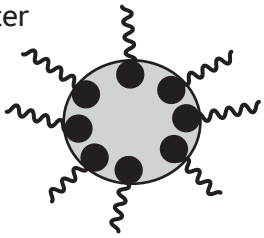
B Moving the thermometer

C Using a glass beaker instead of a copper can

D Stirring the water

[Turn over

18. Which line in the table best describes the ball-like structures formed when soap is added to an oil and water mixture?

	Diagram	Description
A	water 	non-polar head dissolves in water, ionic tail dissolves in oil droplet
B	water 	ionic head dissolves in water, non-polar tail dissolves in oil droplet
C	water 	non-polar head dissolves in oil droplet, ionic tail dissolves in water
D	water 	ionic head dissolves in oil droplet, non-polar tail dissolves in water

19. In an experiment, nickel oxide is added to sulfuric acid until no more nickel oxide reacts. The products are nickel sulfate and water.

The correct method to separate and collect a dry, pure sample of nickel sulfate is

A evaporation

B filtration

C filtration followed by evaporation

D evaporation followed by filtration.

20. Which of the following compounds would react with sodium hydroxide solution to form a salt?

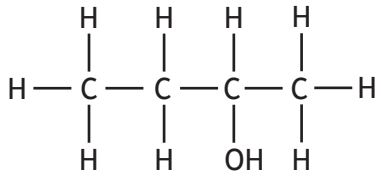
A CH_3CHO

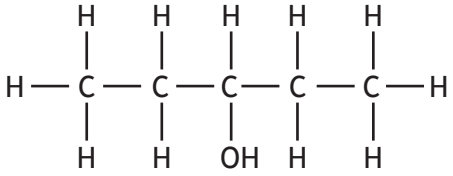
B CH_3COOH

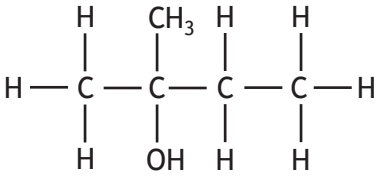
C CH_3COCH_3

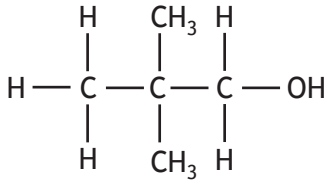
D CH_3CH_2OH

21. Which structural formula represents a primary alcohol?

A 

B 

C 

D 

22. Reduction of 4-methylpentan-2-one to the corresponding alcohol results in the molecule

A gaining 2 g per mole

B losing 2 g per mole

C losing 16 g per mole

D not changing in mass.

23. Which of the following gas samples has the same volume as 16.0 g of oxygen?
(All volumes are measured at the same temperature and pressure)

A 21.0 g of carbon monoxide

B 44.0 g of carbon dioxide

C 46.0 g of nitrogen dioxide

D 46.0 g of dinitrogen tetroxide

[Turn over

24. The number of moles of positive ions in 0.25 moles of aluminium sulfate is

A 0.5

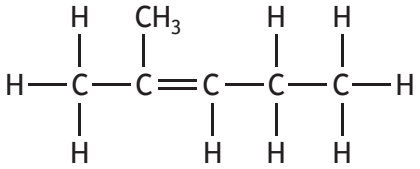
B 1.0

C 2.0

D 3.0

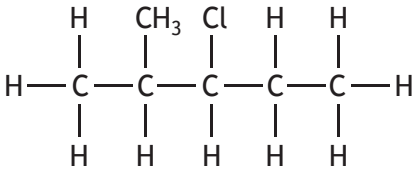
25. Addition of hydrogen chloride, HCl, to an alkene can give a mixture of two products. The product produced in the greatest amount in the reaction is called the major product.

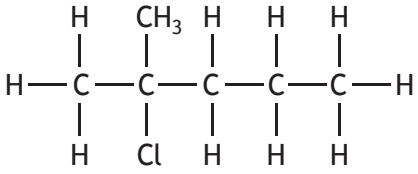
The major product is formed when the hydrogen atom of HCl attaches to the carbon atom of the double bond that has the greatest number of hydrogen atoms attached.

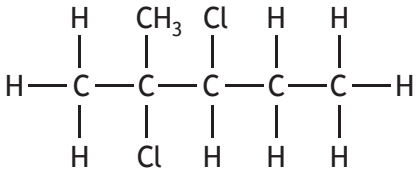


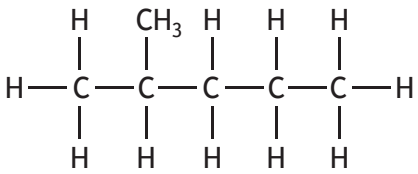
2-methylpent-2-ene

The major product in the reaction of HCl with the 2-methylpent-2-ene is

A 

B 

C 

D 

[END OF QUESTION PAPER]

SPACE FOR ROUGH WORK

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