H

National Qualifications 2022

X813/76/12

Chemistry
Paper 1 — Multiple choice

FRIDAY, 29 APRIL
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.
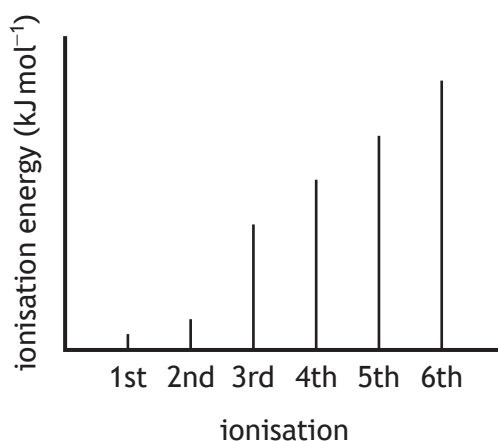
SQA ©

X813/76/12

A/PB

Total marks — 25

Attempt ALL questions

1. An element contains covalent bonding and London dispersion forces.
    The element could be:

    A   boron

    B   neon

    C   sodium

    D   sulfur.

2. The graph below shows the relative quantities of energy equivalent to successive ionisation energies for an element.

    The most stable ion formed from an atom of this element has a charge of:

    A   2+

    B   3+

    C   2−

    D   3−

3. HCl has a higher boiling point than H_2 because:

    A   the polar covalent bonds in HCl are stronger than the covalent bonds in H_2

    B   the polar covalent bonds in HCl are stronger than the van der Waals' forces in H_2

    C   the van der Waals' forces in HCl are stronger than the van der Waals' forces in H_2

    D   the van der Waals' forces in HCl are stronger than the covalent bonds in H_2.

4. Which line in the table would best describe elements that act as reducing agents?

	Gains or loses electrons	Electronegativity
A	gains	low
B	loses	low
C	gains	high
D	loses	high

**5.** The correct redox equation for the reaction of iron(II) ions with acidified dichromate ions is:

A $\quad Cr_2O_7^{2-}(aq) + 14H^+(aq) + Fe^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 7H_2O(\ell) + Fe(s)$

B $\quad Cr_2O_7^{2-}(aq) + 14H^+(aq) + Fe^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 7H_2O(\ell) + Fe^{3+}(aq)$

C $\quad Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6Fe^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 7H_2O(\ell) + 6Fe(s)$

D $\quad Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6Fe^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 7H_2O(\ell) + 6Fe^{3+}(aq)$

6. A mixture of magnesium bromide and magnesium sulfate is known to contain 3 moles of magnesium ions and 4 moles of bromide ions.

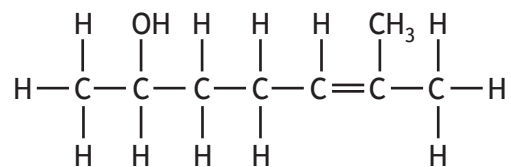How many moles of sulfate ions are present?

A $\quad$ 1

B $\quad$ 2

C $\quad$ 3

D $\quad$ 4

7.
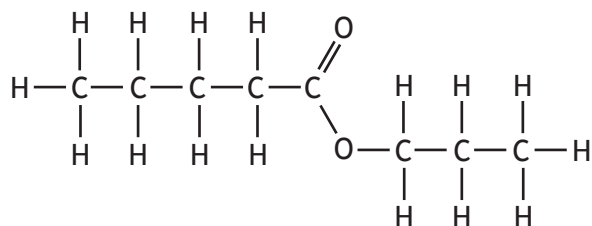
The correct name for this ester is:

A $\quad$ butyl propanoate

B $\quad$ propyl butanoate

C $\quad$ pentyl propanoate
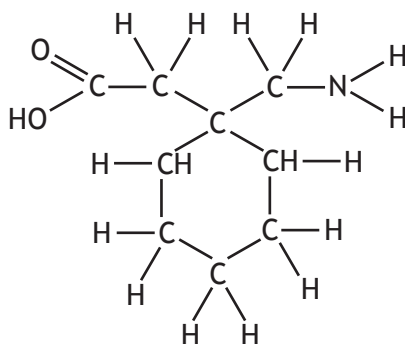
D $\quad$ propyl pentanoate.

[Turn over

8. The structural formula for a compound is shown.

Which of the following is **not** an isomer of this compound?

A   octan-4-one

B   2-ethylhexanal

C   2-ethylhexan-1-ol
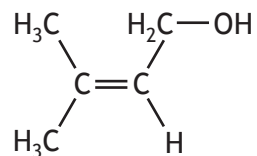
D   5-methylheptan-3-one

9. Gabapentin is a medicine that can be used to treat nerve pain.

Which line in the table shows the two functional groups present in this compound?

A	amine	carboxyl
B	amine	hydroxyl
C	hydroxyl	carboxyl
D	hydroxyl	carbonyl

10. Prenol is a compound that occurs naturally in citrus fruits.

$$H_3C \quad\quad H_2C-OH$$
$$\diagdown \quad\quad \diagup$$
$$C=C$$
$$\diagup \quad\quad \diagdown$$
$$H_3C \quad\quad\quad H$$

Which line in the table correctly describes the reaction of prenol with bromine solution and with hot copper(II) oxide?

	Reaction with bromine solution	Reaction with hot copper(II) oxide
A	no reaction	no reaction
B	no reaction	brown solid formed
C	decolourises	brown solid formed
D	decolourises	no reaction

11. The iodine number of an oil is the mass of iodine, in grams, that will react with 100 g of oil and is a measure of the degree of saturation.

Olive oil has an iodine number of 84 and palm oil has an iodine number of 48.

Which of the following statements is correct?

A   Palm oil is more saturated and has a lower melting point than olive oil.

B   Palm oil is more saturated and has a higher melting point than olive oil.

C   Palm oil is less saturated and has a lower melting point than olive oil.

D   Palm oil is less saturated and has a higher melting point than olive oil.

[Turn over

**12.** The structure of a soapless detergent molecule is given below.

tail section   head section
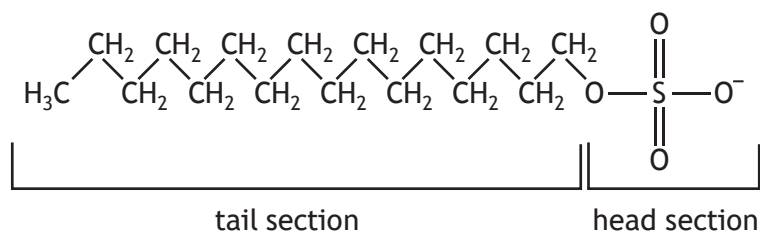
Which line in the table describes a step in the cleansing action of a soapless detergent?

	Head section	Tail section
A	The hydrophobic head dissolves in water.	The hydrophilic tail dissolves in oil.
B	The hydrophilic head dissolves in water.	The hydrophobic tail dissolves in oil.
C	The hydrophobic head dissolves in oil.	The hydrophilic tail dissolves in water.
D	The hydrophilic head dissolves in oil.	The hydrophobic tail dissolves in water.

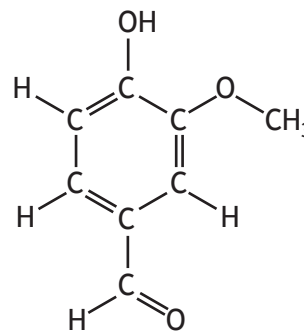**13.** Which of the following is a secondary alcohol?

A   2-methylbutan-1-ol

B   2-methylbutan-2-ol

C   butan-1-ol
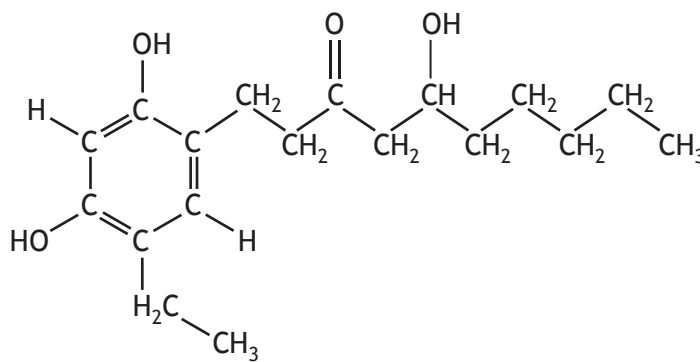
D   butan-2-ol

14. The compounds below are examples of flavour molecules found in some plants.
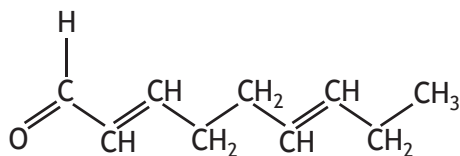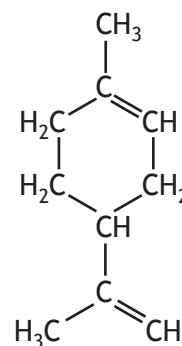


cucumber flavour

vanilla flavour

ginger flavour

orange flavour

Which line in the table shows the solubilities of these compounds in water and in oil?

|	Water soluble	Oil soluble
A	cucumber and ginger	orange and vanilla
B	cucumber and orange	ginger and vanilla
C	ginger and vanilla	cucumber and orange
D	orange and vanilla	cucumber and ginger

[Turn over

15. The structural formula for a compound is shown.

$$H_3C-\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-\underset{\underset{H}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$$
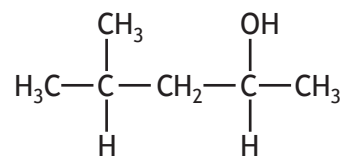
The product of oxidation of this compound is:

A   2-methylpentan-4-one

B   4-methylpentan-2-one

C   2-methylpentanal

D   4-methylpentanal.

16. Which of the following describes how to fill a burette with acid and take the initial reading in a titration?

A   Rinse the burette with the acid. Fill to above the scale with acid. Drain some of the acid and read from the top of the meniscus.

B   Rinse the burette with deionised water. Fill to above the scale with acid. Drain some of the acid and read from the bottom of the meniscus.

C   Rinse the burette with the acid. Fill to above the scale with acid. Drain some of the acid and read from the bottom of the meniscus.

D   Rinse the burette with deionised water. Fill to above the scale with acid. Drain some of the acid and read from the top of the meniscus.

17. Tomato juice contains a mixture of terpenes including lycopene and beta-carotene.

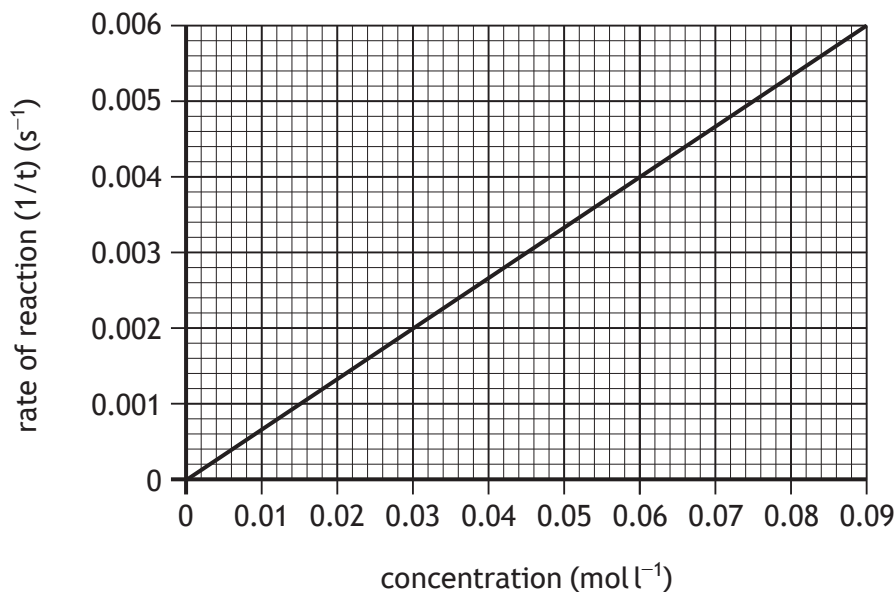Terpenes can be separated using chromatography.
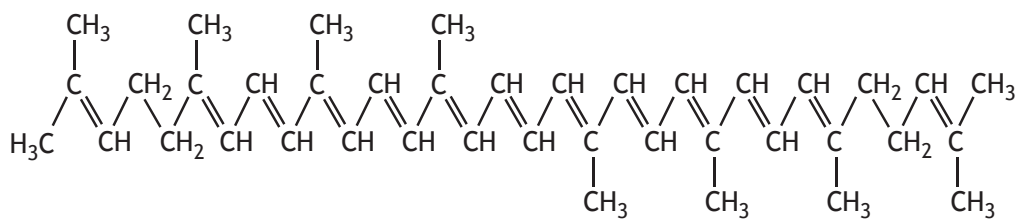
lycopene
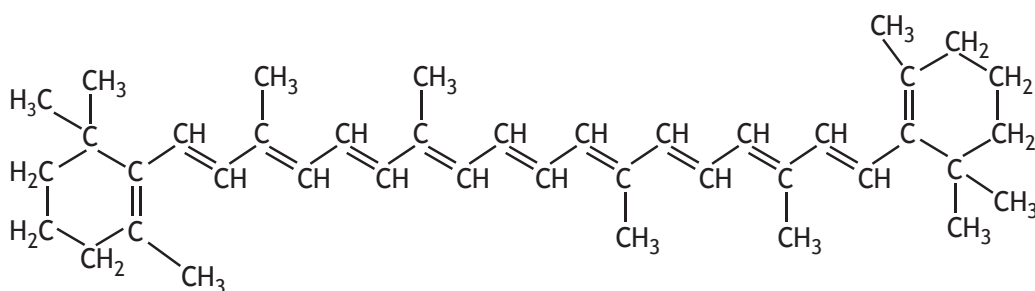
beta-carotene

Which of the following is the most suitable solvent to separate lycopene and beta-carotene?
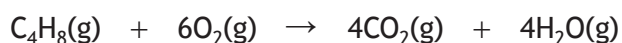
A   Ethanol

B   Pentane

C   Propanoic acid

D   Water

[Turn over

18. The graph shows how the rate of a reaction varies with the concentration of a reactant.

When the concentration of the reactant is 0.06 mol l^{-1}, the reaction time is:

A   0.004 s

B   0.09 s

C   17 s

D   250 s.

19. Butene reacts with oxygen as shown.

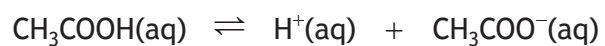$$C_4H_8(g) \ + \ 6O_2(g) \ \rightarrow \ 4CO_2(g) \ + \ 4H_2O(g)$$

100 cm^3 of butene was reacted with excess oxygen.

Compared with the total volume of gases before reaction, what would be the total volume of gases after complete reaction?

A   100 cm^3 more

B   100 cm^3 less

C   300 cm^3 more

D   300 cm^3 less

20. In aqueous solution ethanoic acid forms an equilibrium mixture with its ions.

$$CH_3COOH(aq) \rightleftharpoons H^+(aq) + CH_3COO^-(aq)$$

Which of the following solutions, when added to the equilibrium mixture, would favour the forward reaction?

A   NaCl(aq)

B   HCl(aq)

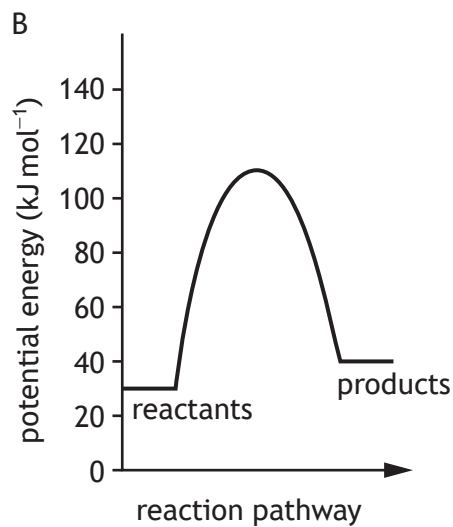C   NaOH(aq)

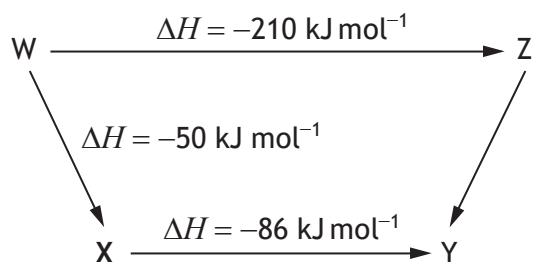D $CH_3COONa(aq)$

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

Enthalpy of reactants (kJ mol^{-1})	Activation energy of forward reaction (kJ mol^{-1})	Activation energy of reverse reaction (kJ mol^{-1})
30	110	70

Which of the following correctly shows the potential energy diagram for the above conditions?

A

B

C

D
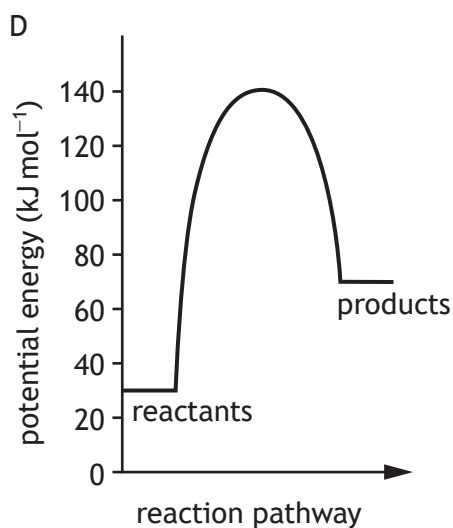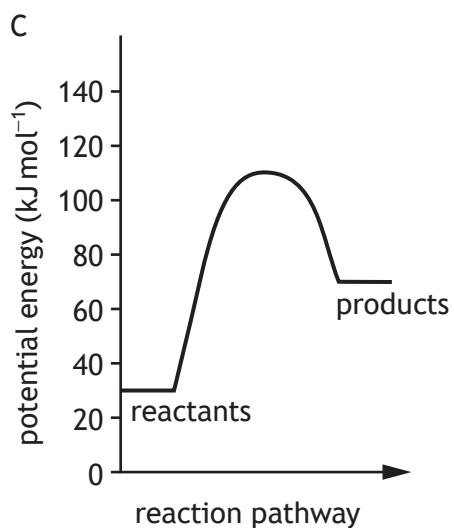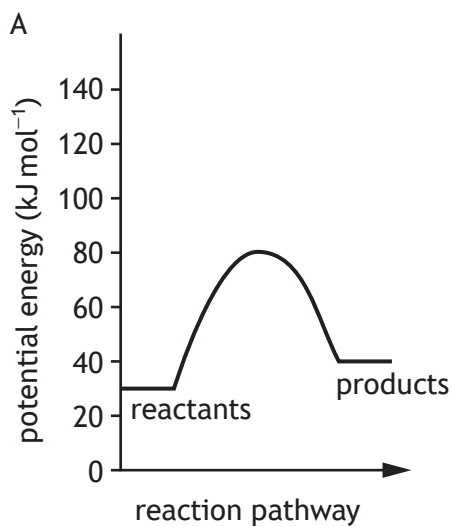
22. Consider the reaction pathway below.

$$W \xrightarrow{\;\Delta H = -210 \text{ kJ mol}^{-1}\;} Z$$

$\Delta H = -50 \text{ kJ mol}^{-1}$

$$X \xrightarrow{\;\Delta H = -86 \text{ kJ mol}^{-1}\;} Y$$

According to Hess' law, the ΔH value, in kJ mol^{-1}, for reaction Z to Y is:

A   −74

B   +74

C   −346

D   +346

23. 50.0 cm^3 of 0.100 mol l^{-1} ammonia solution was transferred to a 250 cm^3 volumetric flask. The flask was made up to the mark with deionised water.

The final concentration, in mol l^{-1}, of the ammonia solution is:

A 2.0×10^{-2}

B 2.5×10^{-2}

C 4.0×10^{-2}

D 5.0×10^{-2}

24. An experiment involves reacting 0.02 moles of silver ions with ions of a group 7 element to form 2.868 g of precipitate.

Which of the following is the precipitate?

A   Silver(I) fluoride

B   Silver(I) chloride

C   Silver(I) bromide

D   Silver(I) iodide

[Turn over

25. A titration experiment was carried out to determine the concentration of vitamin C in orange juice.

A sample of the orange juice solution was pipetted into a flask and 10 cm^3 water was added to dilute the sample. Starch indicator was added to the flask. The mixture was then titrated in the flask using iodine solution of known concentration.

Which line in the table shows the most appropriate apparatus to use when carrying out this procedure?

	To add water	Type of flask
A	measuring cylinder	conical flask
B	beaker	conical flask
C	measuring cylinder	volumetric flask
D	beaker	volumetric flask

[END OF QUESTION PAPER]

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK