National
Qualifications
2024

X813/76/12

Chemistry
Paper 1 — Multiple choice

THURSDAY, 23 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. The difference between the first ionisation energies of sodium and chlorine is mainly due to the difference in the

A number of electrons

B number of neutrons

C number of protons

D mass of each atom.

2. Which line in the table is likely to be correct for the element francium?

	State at 30 °C	**Covalent radii (pm)**
A	solid	less than 238
B	liquid	less than 238
C	solid	greater than 238
D	liquid	greater than 238

3. Which of the following contains pure covalent bonds?

A CO_2

B H_2S

C PH_3

D CF_4

4. Iodide ions can be oxidised using acidified potassium permanganate solution.

The equations are

$$2I^-(aq) \rightarrow I_2(aq) + 2e^-$$

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

How many moles of iodide ions are oxidised by one mole of permanganate ions?

A 1

B 2

C 5

D 10

5. In the reaction between potassium sulfite and iodine dissolved in potassium iodide, the species most likely to act as the oxidising agent is

A $I^-(aq)$

B $I_2(aq)$

C $SO_3^{2-}(aq)$

D $SO_4^{2-}(aq)$

6. Isovaleric acid is a compound found in wine and has the shortened structural formula $(CH_3)_2CHCH_2COOH$.

Which of the following is an isomer of isovaleric acid?

A 2-methylbutanoic acid

B 3-methylbutanoic acid

C 2-methylpentanoic acid

D 3-methylpentanoic acid

7. A compound has the molecular formula C_4H_7OH and reacts with acidified potassium dichromate.

The compound is

A a saturated secondary alcohol

B a saturated tertiary alcohol

C an unsaturated secondary alcohol

D an unsaturated tertiary alcohol.

8. The relative rate of a reaction which reached completion in 3 minutes 20 seconds is

A $0.005\ s^{-1}$

B $0.313\ s^{-1}$

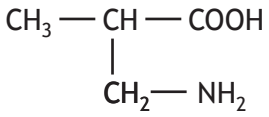
C $0.005\ min^{-1}$

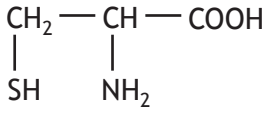
D $0.313\ min^{-1}$

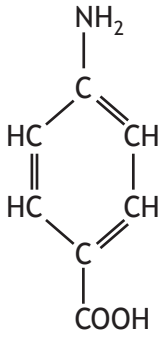
[Turn over

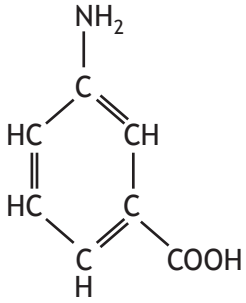
9. Some amino acids are called α-amino acids because the amino group is on the carbon atom next to the acid group.

Which of the following is an α-amino acid?

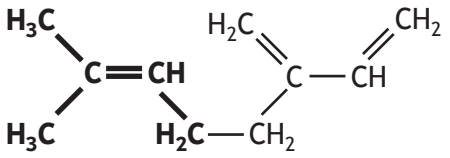
A 

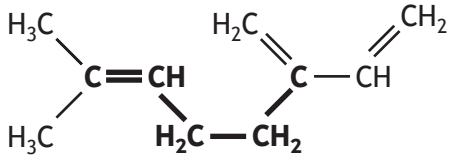
B 

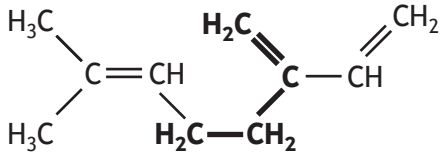
C 

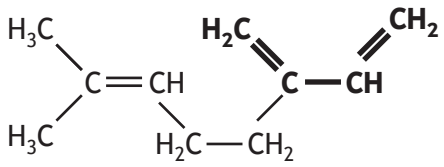
D 

10. Which of the following contains a correctly highlighted isoprene unit?

A 

B 

C 

D 

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11. Edible oil molecules contain carbon to carbon double bonds that can undergo addition reactions with iodine.

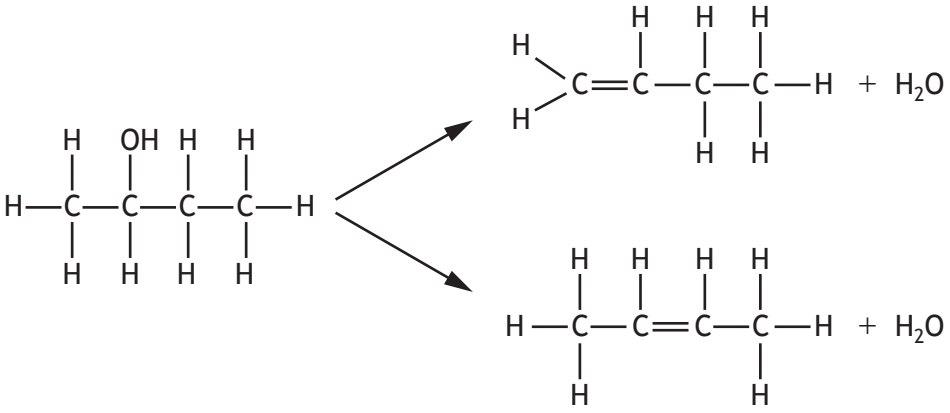
The iodine number of an oil is the mass of iodine, in grams, that will react with 100 g of the oil.

Which line in the table shows the oil that is likely to have the lowest melting point?

	Oil	Iodine number
A	corn	123
B	linseed	179
C	olive	81
D	soya	130

12. Dehydration is the removal of water from a single molecule.

Dehydration of butan-2-ol can produce two isomeric alkenes, but-1-ene and but-2-ene, as shown.



Which of the following alcohols can also produce, on dehydration, two isomeric alkenes?

A Propan-2-ol

B Pentan-3-ol

C Hexan-3-ol

D Heptan-4-ol

13. What type of reaction takes place when propan-1-ol is formed from propanoic acid?

A Condensation

B Hydrolysis

C Oxidation

D Reduction

14. The boiling points of the alkanes increase as the carbon chain length increases due to the increasing strength of

A covalent bonds

B hydrogen bonds

C London dispersion forces

D permanent dipole to permanent dipole interactions.

15. Which of the following is **not** a correct statement about the effect of a catalyst?

A catalyst

A increases the energy of molecules so that there are more successful collisions

B lowers the energy that molecules need for successful collisions

C provides an alternative reaction pathway to the products

D increases the rate of reaction.

16. 5 moles of ammonium phosphate, $(NH_4)_3PO_4$, contains how many moles of positive ions?

A 3

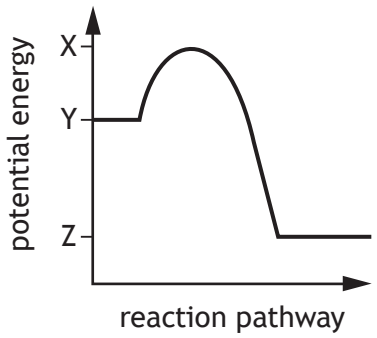
B 5

C 12

D 15

[Turn over

17. A reaction has the potential energy diagram shown.



The enthalpy change for the forward reaction is

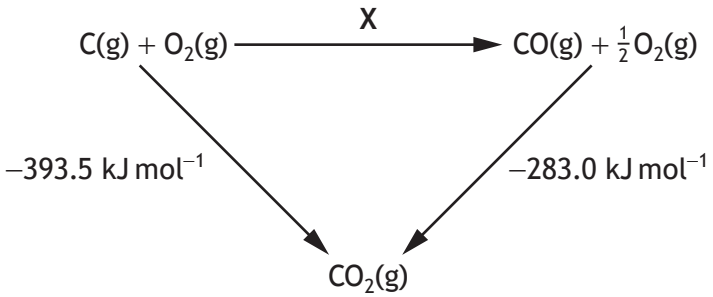
A X − Y

B Y − X

C Y − Z

D Z − Y

18. Consider the reaction pathway shown.



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

A −676.5

B −110.5

C +110.5

D +676.5

19. The mean bond enthalpy of the N-H bond is equal to one third of ΔH for which of the following changes?

A $N(g) + 3H(g) \rightarrow NH_3(g)$

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

C $\frac{1}{2}N_2(g) + 1\frac{1}{2}H_2(g) \rightarrow NH_3(g)$

D $N(g) + 1\frac{1}{2}H_2(g) \rightarrow NH_3(g)$

20. The equation represents a mixture at equilibrium.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

Which line in the table is true for the mixture after a further two hours of reaction under the same conditions?

	Rate of forward reaction	**Rate of back reaction**
A	decreases	decreases
B	increases	increases
C	unchanged	decreases
D	unchanged	unchanged

21. $C(s) + H_2(g) + O_2(g) \rightarrow HCOOH(\ell)$ $\Delta H = a$

$HCOOH(\ell) + \frac{1}{2}O_2(g) \rightarrow CO_2(g) + H_2O(\ell)$ $\Delta H = b$

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = c$

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(\ell)$ $\Delta H = d$

What is the relationship between a, b, c and d?

A $a = c + d - b$

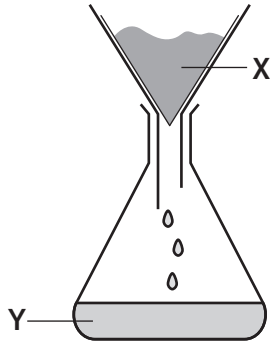
B $a = b - c - d$

C $a = -b - c - d$

D $a = c + b + d$

[Turn over

22. A filtration experiment was carried out to separate **X** and **Y**.



Which line in the table correctly describes **X** and **Y**?

	X	**Y**
A	solvent	residue
B	residue	filtrate
C	filtrate	precipitate
D	residue	solvent

23. Which piece of apparatus should be used to accurately measure 45 cm^3 of a solution?

A 50 cm^3 beaker

B 50 cm^3 pipette

C 50 cm^3 burette

D 50 cm^3 measuring cylinder

24. A student was carrying out a titration.

Which of the following would help the student to accurately observe the end-point?

A Repeating the titration

B Using a white tile under the flask

C Rinsing the flask between titrations

D Disregarding the rough titre

25. Carbon dioxide can be produced by the following reaction.

$$2HCl(aq) + K_2CO_3(aq) \rightarrow 2KCl(aq) + CO_2(g) + H_2O(\ell)$$

The most suitable method of isolating the carbon dioxide is by

A bubbling through calcium hydroxide

B collection over water

C evaporation

D distillation.

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