National Qualifications 2024

X813/75/02

Chemistry
Section 1 — Questions

THURSDAY, 23 MAY

1:00 PM – 3:30 PM

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X813/75/01.

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

You may refer to the Chemistry Data Booklet for National 5.

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

X8137502

SECTION 1 — 25 marks

Attempt ALL questions

1. An experiment was carried out to investigate the rate of a reaction.
In the first 5 minutes the pressure decreased by 0.6 bar.
The unit for the average rate of this reaction is

A bar/min^{-1}

B $bar\ min^{-1}$

C min/bar

D $min\ bar^{-1}$

2. Which two lines in the table show particles that are isotopes of the same element?

Particle	Number of protons	Number of neutrons	Number of electrons
W	11	12	10
X	11	12	11
Y	12	12	12
Z	12	14	12

A W and X

B X and Z

C W and Y

D Y and Z

3. An atom of tin has 74 neutrons.
Which of the following is the mass number of this atom?
You may wish to use the data booklet to help you.

A 50

B 74

C 118.5

D 124

4. Lead forms many compounds with non-metal elements.

At room temperature tetraethylplumbane, $Pb(C_2H_5)_4$, is a liquid that does not conduct electricity and is insoluble in water.

The structure and bonding in tetraethylplumbane is

A covalent molecular

B covalent network

C ionic lattice

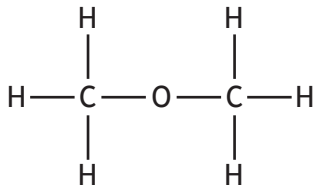
D metallic lattice.

5. Hydrogen bonds are a type of intermolecular force that exists between some molecules.

Hydrogen bonds will exist between molecules that contain a hydrogen atom **directly bonded** to an atom of either nitrogen, oxygen or fluorine.

Which of the following substances will have hydrogen bonds between its molecules?

A



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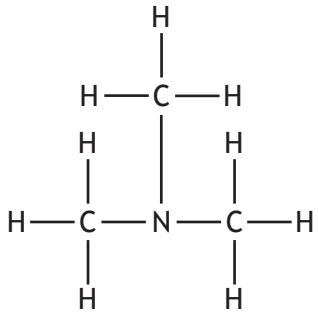

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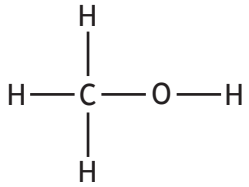

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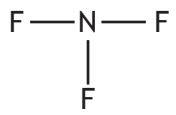

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6. Which of the following compounds, when added to water, will change its pH?

You may wish to use the data booklet to help you.

A Aluminium oxide

B Calcium oxide

C Copper(II) oxide

D Zinc(II) oxide

7. $2Mg + O_2 \rightarrow 2MgO$

How many moles of oxygen would be needed to react completely with 4 moles of magnesium?

A 1

B 2

C 4

D 8

8. Which of the following elements has the lowest gram formula mass?

A Nitrogen

B Oxygen

C Fluorine

D Neon

9. 25 cm^3 of water was added to an aqueous solution of sodium hydroxide.

Compared to the initial sodium hydroxide solution, the final sodium hydroxide solution has

A a lower number of moles of sodium hydroxide and a higher pH

B the same number of moles of sodium hydroxide and a higher pH

C the same number of moles of sodium hydroxide and a lower pH

D a lower number of moles of sodium hydroxide and a lower pH.

10. Which of the following is most likely to be a use for alkanes?

A Fuels

B Soaps

C Medicines

D Flavourings

11. The table shows three members of the cycloalkyne family.

Name	Molecular formula
Cyclooctyne	C_8H_{12}
Cyclononyne	C_9H_{14}
Cyclodecyne	$C_{10}H_{16}$

Which of the following is the general formula for the cycloalkyne family?

A C_nH_{2n}

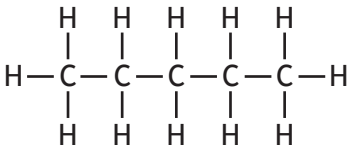
B C_nH_{2n-2}

C C_nH_{2n-4}

D C_nH_{2n-6}

12. Which of the following compounds is an isomer of pent-2-ene?

A



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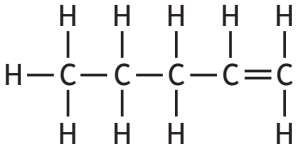

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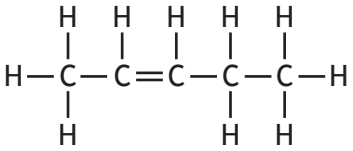

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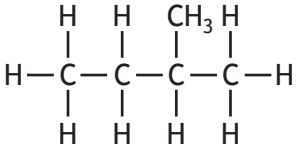

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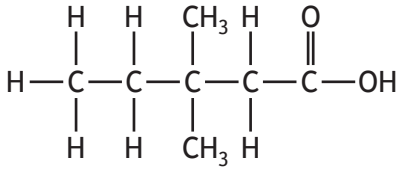
13.



The shortened structural formula for this compound is

A $CH_3CH_2CH(C_2H_5)CH_2COOH$

B $CH_3CH_2C(CH_3)_2CH_2COOH$

C $CH_3CH(C_2H_5)CH_2CH_2COOH$

D $CH_3C(CH_3)_2CH_2CH_2COOH$

14. Which bond do ethane, ethene, ethanol and ethanoic acid **all** contain?

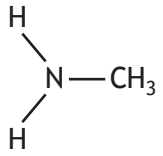
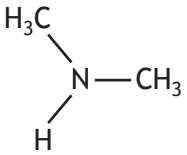
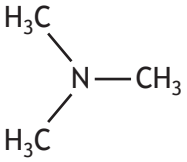
A C—C

B C—O

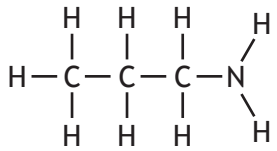
C C—H

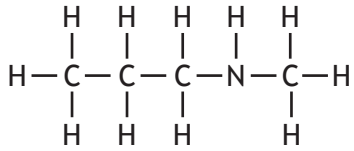
D O—H

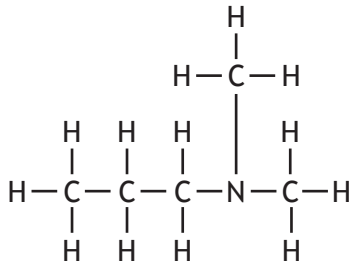
15. The table shows how the number of carbon atoms bonded to the nitrogen atom determines the classification of an amine.

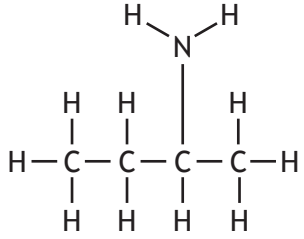
Number of carbon atoms bonded to the nitrogen atom	Example	Amine classification
1		primary
2		secondary
3		tertiary

Which of the following is a secondary amine?

A 

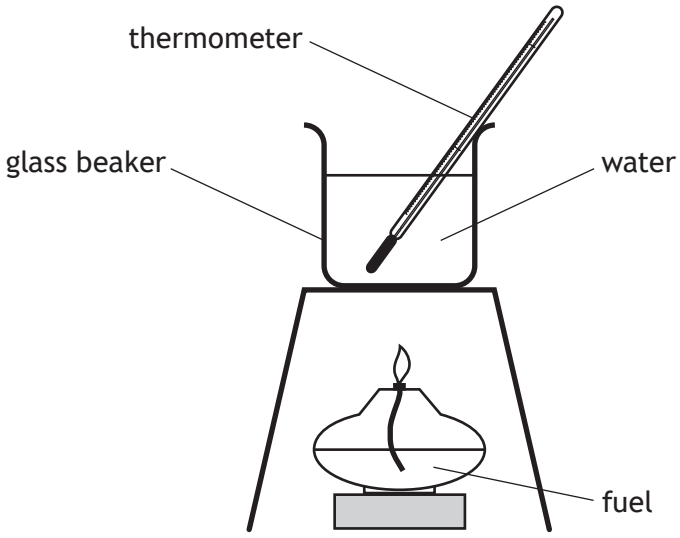
B 

C 

D 

Questions **16** and **17** refer to the experiment below.

The apparatus shown was used to measure the energy released when four different fuels were burned.



16. In which experiment was the most energy released?

	Mass of water (kg)	**Temperature rise (°C)**
A	0.05	10
B	0.05	20
C	0.25	8
D	0.25	18

17. Which of the following changes would **not** improve the experimental results?

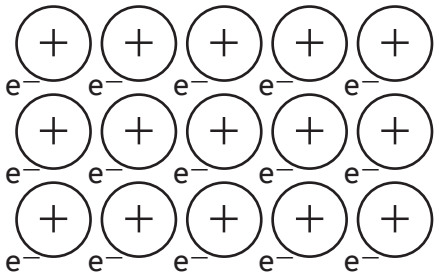
A Increasing the distance between the burner and the beaker

B Placing a lid on the beaker

C Using a copper beaker

D Using a heat shield/draft shield

18. Which of the following substances in the table below would have the following structure?



Substance	Melting point (°C)	Boiling point (°C)	Conducts electricity	
			Solid	Liquid
A	30	2229	yes	yes
B	−118	90	no	no
C	714	1412	no	yes
D	2077	4000	no	no

19. When magnesium reacts with dilute hydrochloric acid, magnesium chloride is formed.

Name the other substance formed.

A Hydrogen chloride

B Hydrogen

C Chlorine

D Water

20. The ion electron equations for the reactions taking place during the electrolysis of aluminium oxide are given below.

$$Al^{3+} + 3e^- \rightarrow Al$$
$$2O^{2-} \rightarrow O_2 + 4e^-$$

The redox equation for the overall reaction is

A $4Al^{3+} + 6O^{2-} \rightarrow 4Al + 3O_2$

B $3Al^{3+} + 3O^{2-} \rightarrow 3Al + 3O_2$

C $Al^{3+} + 2O^{2-} \rightarrow Al + O_2 + e^-$

D $Al^{3+} + 2O^{2-} + 3e^- \rightarrow Al + O_2 + 4e^-$

[Turn over

21. Which of the following statements is true for ammonia?

A It has the formula NH_4^+.

B It will react with acids.

C It will turn damp pH paper red.

D It is a solid at room temperature.

22. Which of the following compounds can be used to provide **two** of the essential elements required for healthy plant growth?

A K_2CO_3

B K_2SO_4

C NH_4NO_3

D $(NH_4)_3PO_4$

23. Which metal is used as the catalyst in the industrial manufacture of ammonia?

A Platinum

B Nickel

C Iron

D Palladium

24. $^{228}_{88}Ra \xrightarrow{\beta \text{ emission}} Q \xrightarrow{\beta \text{ emission}} R \xrightarrow{\alpha \text{ emission}} S$

Identify the radioisotope, S, that is formed when radium-228 decays by emission of two beta particles and an alpha particle.

A $^{220}_{83}Bi$

B $^{220}_{85}At$

C $^{224}_{86}Rn$

D $^{224}_{88}Ra$

25. The table shows the colours of ions in solution.

Ion	Colour in solution
Sodium	colourless
Calcium	colourless
Copper(II)	blue
Chloride	colourless
Chromate	yellow
Dichromate	orange

Which line in the table is correct for the colour in solution and the flame colour when copper(II) chloride is burned?

You may wish to use the data booklet to help you.

	Colour in solution	Flame colour
A	colourless	blue
B	blue-green	blue
C	colourless	blue-green
D	blue	blue-green

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET]

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