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DUNMAN HIGH SCHOOL Preliminary Examination Year 6

H1 CHEMISTRY

Paper 1 Multiple Choice

8873/01

25 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your centre number, index number, name and class at the top of this page.

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **11** printed pages and **1** blank page.

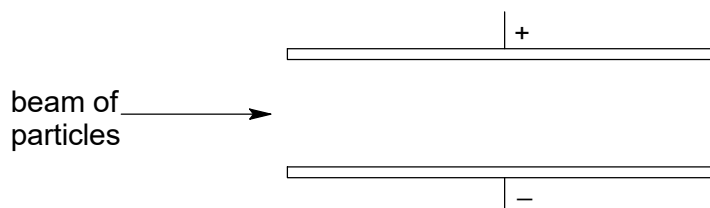
1 *Use of the Data Booklet is relevant to this question*

A 5 g sample of a diatomic gas was found to contain 3.76×10^{22} atoms.

What is the relative molecular mass of this gas?

- | | | | |
|----------|-----|----------|-----|
| A | 40 | B | 80 |
| C | 120 | D | 160 |

2 In two separate experiments, a beam of alpha particles (${}^4\text{He}^{2+}$) and a beam of charged particles **X** were fired with equal velocities into an electric field.



The angle of deflection of the charged particles, ${}^4\text{He}^{2+}$ and **X**, was found to be $+1^\circ$ and $+6^\circ$ respectively.

Which statement is correct?

- A** **X** is negatively charged.
- B** **X** travels in a straight path towards one of the charged plates.
- C** **X** could be a ${}^{12}\text{C}^+$ ion.
- D** None of the above.

3 *Use of the Data Booklet is relevant to this question.*

Which of the following electronic configurations represents an element that forms a simple ion with a charge of -3 ?

- A** $1s^2 2s^2 2p^6 3s^2 3p^1$
- B** $1s^2 2s^2 2p^6 3s^2 3p^3$
- C** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1 4s^2$
- D** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$

- 4 *Use of the Data Booklet is relevant to this question.*

W is an isotope of an element. An isotope of strontium has a nucleon number of 84 and the same number of neutrons in the nucleus as the isotope **W**.

The species Sr^{2+} and **W** contain the same number of electrons.

What is the nucleon number of **W**?

- A 80
- B 82
- C 83
- D 84

- 5 *Use of the Data Booklet is relevant to this question.*

Which particle contains a single unpaired electron?

- A Cr atom
- B Cu^+ ion
- C H_2S molecule
- D NO_2 molecule

- 6 The molecules $\text{O}=\text{C}=\text{O}$, $\text{S}=\text{C}=\text{S}$ and $\text{O}=\text{C}=\text{S}$ are all linear.

Which statements are correct?

- 1 The molecules all contain polar covalent bonds.
- 2 Only $\text{O}=\text{C}=\text{S}$ has permanent dipole–permanent dipole interactions.
- 3 $\text{O}=\text{C}=\text{S}$ has stronger instantaneous dipole–induced dipole interactions than $\text{S}=\text{C}=\text{S}$.

- | | |
|----------------|----------------|
| A 1 and 2 only | B 1 and 3 only |
| C 2 and 3 only | D 1, 2 and 3 |

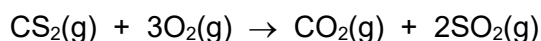
- 7 Which row correctly describes the structure and bonding present in the solid lattice of the given substance?

	substance	structure	bonding
A	ice	giant molecular	covalent and hydrogen bonding
B	iodine	simple molecular	covalent bonding and permanent dipoles
C	sodium nitrate	giant ionic	ionic and covalent bonding
D	manganese	giant metallic	ionic bonding

- 8 Which statement best explains why the boiling point of $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ is higher than that of $(\text{CH}_3)_3\text{N}$?

- A** $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ molecule is polar while $(\text{CH}_3)_3\text{N}$ molecule is non-polar.
B There are more electrons in $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ molecule than $(\text{CH}_3)_3\text{N}$ molecule.
C The surface area of $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ molecule is larger than that of $(\text{CH}_3)_3\text{N}$ molecule.
D There are hydrogen bonds between $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ molecules but not between $(\text{CH}_3)_3\text{N}$ molecules.

- 9 Carbon disulfide vapour burns in oxygen according to the following equation.



10 cm^3 of carbon disulfide was burned in 50 cm^3 of oxygen. After measuring the volume of gas remaining, the resulting mixture was treated with an excess of aqueous sodium hydroxide and the volume of gas measured again.

What were the measured volumes?

	volume of gas after burning / cm^3	volume of gas after adding $\text{NaOH}(\text{aq})$ / cm^3
A	30	0
B	30	20
C	50	20
D	50	40

- 10** 0.00200 mol of nitrate ions was reduced by 30.0 cm³ of 0.200 mol dm⁻³ iron(II) sulfate and an iron(III) product was formed.

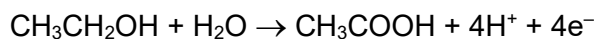
What is a possible identity of the nitrogen-containing product?

- | | |
|---------------------------------------|--------------------------|
| A N ₂ | B NO |
| C NO ₂ ⁻ | D NO ₂ |

- 11** *Use of the Data Booklet is relevant to this question.*

When acidified potassium dichromate(VI) acts as an oxidising agent, the Cr₂O₇²⁻ ion is reduced to Cr³⁺.

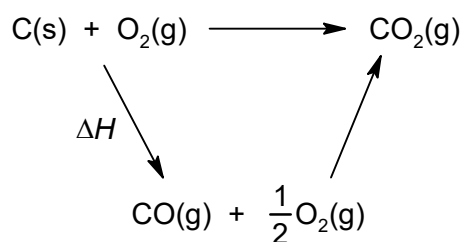
Ethanol is oxidised to ethanoic acid as shown.



How many moles of ethanol molecules are oxidised by 1 mol of potassium dichromate(VI)?

- | | |
|---------------|---------------|
| A 0.67 | B 0.75 |
| C 1.33 | D 1.50 |

- 12** An energy cycle is shown below.



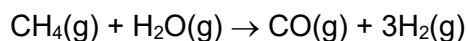
Which data values are required to calculate ΔH ?

- 1 the standard enthalpy change of formation of oxygen
- 2 the standard enthalpy change of formation of carbon dioxide
- 3 the standard enthalpy change of combustion of carbon monoxide

- | | |
|-----------------------|-----------------------|
| A 1 and 2 only | B 2 and 3 only |
| C 1 and 3 only | D 1, 2 and 3 |

- 13 Use of the Data Booklet is relevant to this question.

The steam reforming process is described by the equation below.



What is the enthalpy change of the reaction?

- A** +175 kJ mol⁻¹ **B** -175 kJ mol⁻¹
C +892 kJ mol⁻¹ **D** -892 kJ mol⁻¹

- 14 Which equation corresponds to the stated enthalpy change?

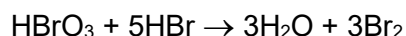
	equation	enthalpy change
A	$\text{P}(\text{s}) + \frac{5}{2}\text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5(\text{s})$	formation
B	$\text{H}^+(\text{g}) + \text{OH}^-(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$	neutralisation
C	$\text{Na}_2\text{O}(\text{s}) \rightarrow 2\text{Na}^+(\text{g}) + \text{O}^{2-}(\text{g})$	lattice energy
D	$2\text{Cl}(\text{g}) \rightarrow \text{Cl}_2(\text{g})$	bond energy

- 15 The rate of removal of aspirin, a pain-killer drug, from the body follows a first-order reaction. It takes 6.0 hours for 87.5% of aspirin to be removed from the body.

How much time does it take for 50% of aspirin to be removed from the body?

- A** 120 min **B** 180 min
C 206 min **D** 240 min

- 16 Bromic acid and hydrobromic acid undergo a redox reaction to form bromine.



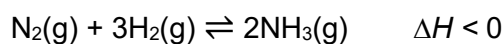
The rate equation is shown below.

$$\text{rate} = k[\text{BrO}_3^-][\text{Br}^-][\text{H}^+]^2$$

What are the units of the rate constant, k ?

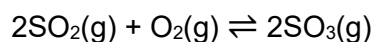
- A** mol⁻⁴ dm¹² s⁻¹ **B** mol⁻³ dm⁹ s⁻¹
C mol⁻² dm⁶ s⁻¹ **D** mol dm⁻³ s⁻¹

- 17 Which statement is correct for the equilibrium below?



	change	effect on position of equilibrium	effect on K_c
A	addition of catalyst	shifts right	no change
B	addition of ammonia gas	shifts left	decreases
C	decrease in temperature	shifts right	increases
D	increase in pressure of vessel	shifts left	no change

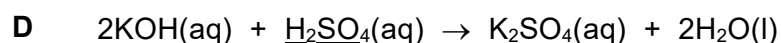
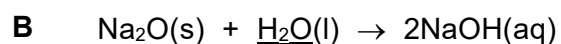
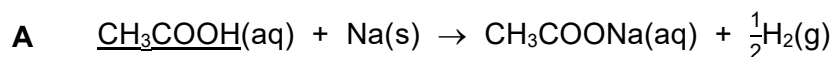
- 18 When a mixture of 2 mol of sulfur dioxide and 1 mol of oxygen is allowed to reach equilibrium at a given temperature, the mixture is found to contain x mol of sulfur dioxide.



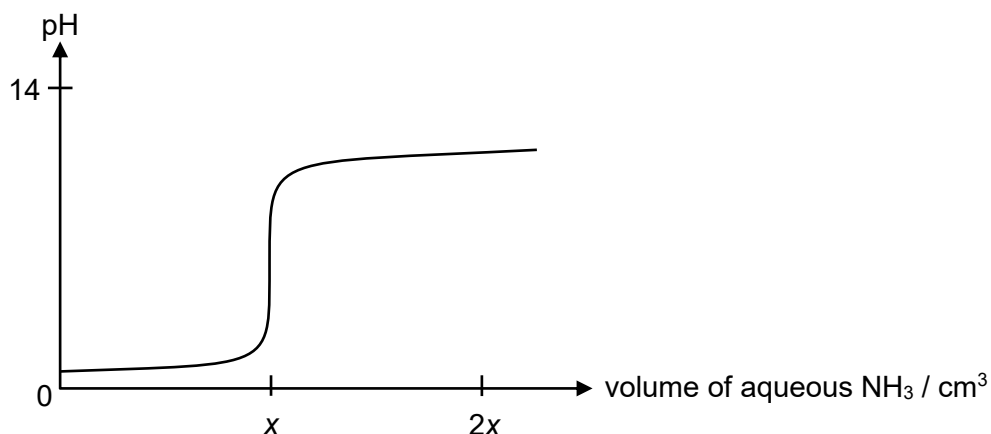
What are the amounts of the three species at equilibrium?

	SO_2 / mol	O_2 / mol	SO_3 / mol
A	x	$x/2$	$2 - x$
B	x	$1 - x$	x
C	x	$x/2$	x
D	x	$1 - x$	$2 - x$

- 19 In which reaction is the underlined substance in the equation acting as a Brønsted–Lowry base?



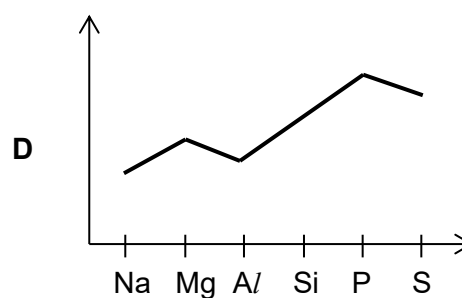
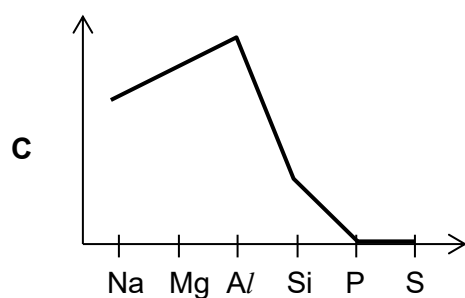
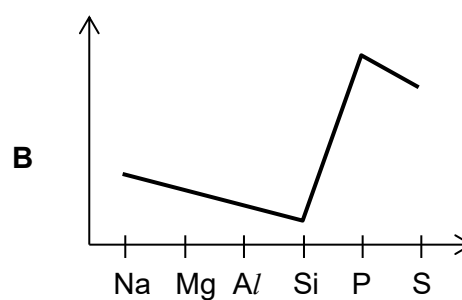
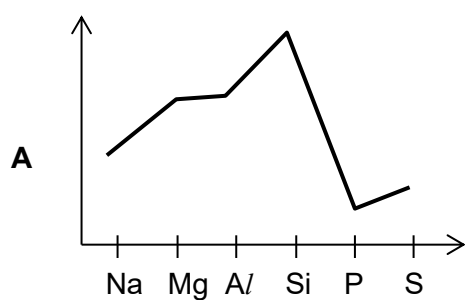
- 20** 25 cm³ of 0.1 mol dm⁻³ aqueous sulfuric acid was titrated with aqueous ammonia of the same concentration and the following graph is obtained.
(The graph is not drawn to scale.)



Which statement is correct?

- A** The initial pH of the solution is 1.
B Equivalence point for this titration is at pH 7.
C When 2x cm³ of NH₃ is added, a buffer solution is obtained.
D The value of x is 25.

- 21** Which graph shows how electrical conductivity of Period 3 elements varies?



- 22** **K**, **L** and **M** are elements with atomic numbers between 11 and 18. They have the following properties compared to other elements in Period 3.

- **K** has the largest ionic radii.
- **L** has the highest melting point.
- **M** has the second highest electrical conductivity at room temperature.

Arrange the elements in order of increasing atomic number.

A **K, L, M**

B **L, M, K**

C **K, M, L**

D **M, L, K**

- 23** Which statement is true about the elements in Group 1 of the Periodic Table?

- 1 They react with water to give off oxygen gas.
- 2 They are more readily oxidised down the group.
- 3 Sodium is more electronegative than caesium.
- 4 They can conduct electricity in the solid state, but not in liquid state.

A 2 and 3 only

B 1 and 3 only

C 2 and 4 only

D 4 only

- 24** Due to its radioactive nature, the properties of astatine, At, have to be estimated based on its position in the Periodic Table.

Which prediction concerning At or its compounds is correct?

- A** Astatine is a liquid at room temperature.
- B** Iodine is a stronger oxidising agent than astatine.
- C** Astatine forms diatomic molecules which dissociate into atoms less readily than iodine molecules.
- D** Hydrogen astatide has a higher decomposition temperature than hydrogen iodide.

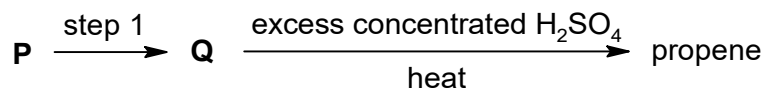
- 25 What is the number of non-cyclic constitutional (structural) isomers of $C_3H_4Cl_2$ that exhibit cis-trans isomerism?

A 2 B 3 C 4 D 5

- 26 When one ethene molecule reacts with one chlorine molecule by addition, how many bonds are broken and formed?

	number of σ bonds broken	number of π bonds broken	number of σ bonds formed
A	0	1	2
B	1	0	2
C	1	1	1
D	1	1	2

- 27 Propene can be synthesised using the following two-step process.



What could be compound **P** and the reagent required for step 1?

	P	reagent
A	propanone	acidified $K_2Cr_2O_7$
B	propan-2-ol	acidified $K_2Cr_2O_7$
C	2-chloropropane	aqueous NaOH
D	propanoic acid	aqueous NaOH

- 28 Which carboxylic acid and alcohol are used to make 2-methylpropyl ethanoate?

A $CH_3CH_2CO_2H$ and CH_3CH_2OH
 B $(CH_3)_2CHCO_2H$ and CH_3CH_2OH
 C CH_3CO_2H and $CH_3CH_2CH_2OH$
 D CH_3CO_2H and $(CH_3)_2CHCH_2OH$

29 Polymers are used extensively in our daily lives.

Which row best describes the most suitable polymer to use for each type of product?

	soft contact lenses	wrinkle-free shirts	microwavable food packaging	bottles for alkaline cleaning solutions
A	poly(vinyl alcohol)	polyamide	LDPE	PET
B	poly(vinyl alcohol)	polyester	poly(propene)	HDPE
C	poly(vinyl chloride)	polyamide	LDPE	PET
D	poly(vinyl chloride)	polyester	poly(propene)	HDPE

30 Why is the use of nanoparticles as heterogeneous catalyst preferred over traditional catalysts?

- 1 They are easily found in natural sources.
- 2 They have a higher surface area to volume ratio.
- 3 They are cheaper.
- 4 They are safer.

A 1 and 3 only

B 2 and 3 only

C 2 and 4 only

D 3 and 4 only

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