

<b>Name:</b>		<b>Centre/Index Number:</b>		<b>Class:</b>	
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## DUNMAN HIGH SCHOOL Preliminary Examination Year 6

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### H2 CHEMISTRY

Paper 1 Multiple Choice

**9729/01**

**25 September 2025**

**1 hour**

Additional Materials: Multiple Choice Answer Sheet  
Data Booklet

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#### 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.

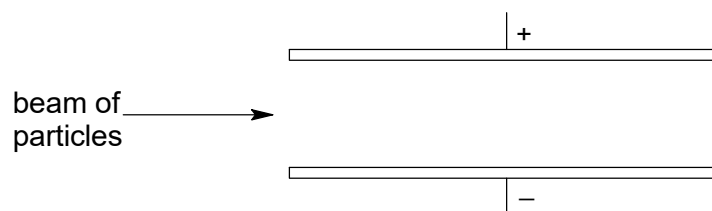
Any rough working should be done in this booklet.

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

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This document consists of **12** printed pages.

- 1 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.
- 2 *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  $\text{Sr}^{2+}$  and **W** contain the same number of electrons.

What is the nucleon number of **W** and how many orbitals are occupied in its valence shell?

	<b>W</b>	number of orbitals occupied in valence shell
<b>A</b>	80	3
<b>B</b>	82	4
<b>C</b>	82	3
<b>D</b>	84	4

- 3 The molecules  $\text{CO}_2$ ,  $\text{CS}_2$  and  $\text{COS}$  have the same shape.

Which statements are correct?

- 1 The molecules all contain polar covalent bonds.
- 2 The molecules each contain two sigma and two pi bonds.
- 3 Only  $\text{COS}$  has permanent dipole–permanent dipole interactions.
- 4  $\text{COS}$  has stronger instantaneous dipole–induced dipole interactions than  $\text{CS}_2$ .

**A** 1, 2 and 3 only

**B** 2 and 4 only

**C** 2 and 3 only

**D** 1 and 4 only

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

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

- 5 Analysis of a mixture of sulfur-containing gases shows that hydrogen sulfide,  $\text{H}_2\text{S}$ , and carbon disulfide,  $\text{CS}_2$ , are present in a 2 : 1 mole ratio.

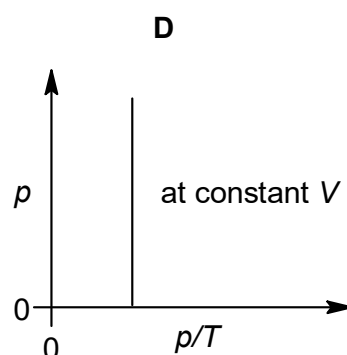
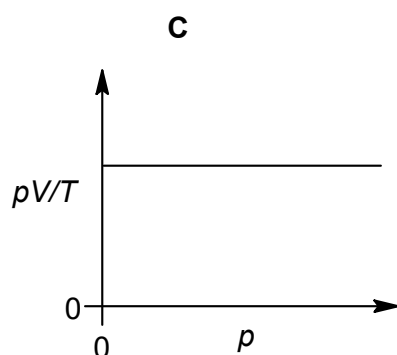
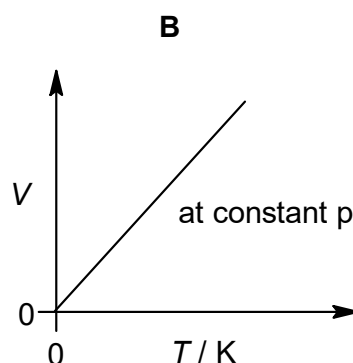
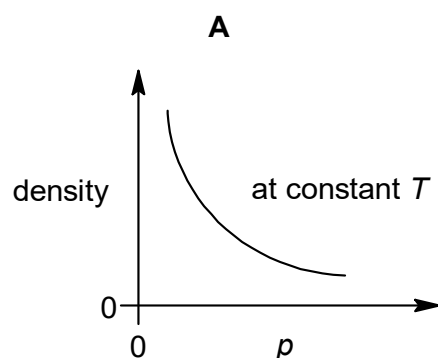
60  $\text{cm}^3$  of the gaseous mixture is burned in excess oxygen. The resulting gases are bubbled through aqueous sodium hydroxide. All volumes are measured under the same temperature and pressure.

Which row correctly describes

- the  $\text{SO}_2$  :  $\text{CO}_2$  mole ratio in the gaseous mixture obtained after complete combustion and
- the reduction in volume of the gaseous mixture when bubbled through  $\text{NaOH}(\text{aq})$ ?

	$\text{SO}_2$ : $\text{CO}_2$ mole ratio	reduction in volume
<b>A</b>	3 : 1	80 $\text{cm}^3$
<b>B</b>	4 : 1	80 $\text{cm}^3$
<b>C</b>	3 : 1	100 $\text{cm}^3$
<b>D</b>	4 : 1	100 $\text{cm}^3$

- 6 Which graph does **not** represent the behaviour of a fixed mass of an ideal gas?



- 7 0.00200 mol of nitrate ions was reduced by 30.0 cm<sup>3</sup> of 0.200 mol dm<sup>-3</sup> iron(II) sulfate to form a brown iron(III) complex.

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

- |                   |                 |
|-------------------|-----------------|
| <b>A</b> $N_2$    | <b>B</b> $NO$   |
| <b>C</b> $NO_2^-$ | <b>D</b> $NO_2$ |

- 8 **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.

- |   |   |
|---|---|
| <b>A</b> <b>K</b> , <b>L</b> , <b>M</b> | <b>B</b> <b>L</b> , <b>M</b> , <b>K</b> |
| <b>C</b> <b>K</b> , <b>M</b> , <b>L</b> | <b>D</b> <b>M</b> , <b>L</b> , <b>K</b> |

9 Which trends down a Group in the Periodic Table are correct?

- 1 Electronegativity of Group 1 elements decreases
- 2 Reducing power of Group 2 elements increases
- 3 Volatility of Group 17 elements increases

- |                       |                       |
|-----------------------|-----------------------|
| <b>A</b> 1 and 2 only | <b>B</b> 2 and 3 only |
| <b>C</b> 1 and 3 only | <b>D</b> 1, 2 and 3   |

10 The standard entropy change of formation,  $\Delta S_f^\ominus$ , of a substance is similarly defined as the standard enthalpy change of formation,  $\Delta H_f^\ominus$ .

Which Period 3 oxide has the most negative  $\Delta S_f^\ominus$ ?

- |                          |                          |
|--------------------------|--------------------------|
| <b>A</b> sodium oxide    | <b>B</b> magnesium oxide |
| <b>C</b> silicon dioxide | <b>D</b> sulfur dioxide  |

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

Which solid has the most exothermic lattice energy?

[Assume the lattice structure of the following compounds are identical.]

- |                         |                         |
|-------------------------|-------------------------|
| <b>A</b> $\text{TiF}_3$ | <b>B</b> $\text{FeF}_3$ |
| <b>C</b> $\text{TiO}$   | <b>D</b> $\text{FeO}$   |

12 0.70 g of fuel undergoes complete combustion to heat up 500 cm<sup>3</sup> of water by 7.5 °C. The system is known to be 70% efficient.

What is the energy released per gram, in kJ g<sup>-1</sup>, of the fuel burnt?

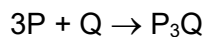
- |               |               |
|---------------|---------------|
| <b>A</b> 15.7 | <b>B</b> 22.4 |
| <b>C</b> 32.0 | <b>D</b> 1196 |

13 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.

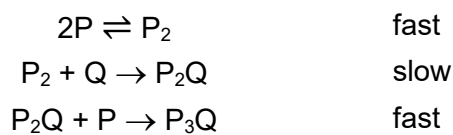
What is the value of the rate constant for this reaction?

- |                                |                                 |
|--------------------------------|---------------------------------|
| <b>A</b> 0.462 h <sup>-1</sup> | <b>B</b> 0.347 h <sup>-1</sup>  |
| <b>C</b> 0.116 h <sup>-1</sup> | <b>D</b> 0.0385 h <sup>-1</sup> |

- 14 Consider the following reaction:

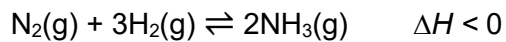


The proposed mechanism for the reaction involves the following steps:



Based on the given information, what is the rate equation for the reaction?

- A** rate =  $k[P]^2[Q]$   
**B** rate =  $k[P_2][Q]$   
**C** rate =  $k[P]^2$   
**D** rate =  $k[P]^3[Q]$
- 15 Which statement is correct for the equilibrium below?



	change	effect on position of equilibrium	effect on $K_c$
<b>A</b>	addition of catalyst	shifts right	no change
<b>B</b>	addition of argon gas at constant volume	shifts left	decreases
<b>C</b>	decrease in temperature	shifts right	increases
<b>D</b>	decrease in volume of vessel	shifts left	no change

- 16** Solutions **E**, **F**, **G** and **H** contain  $\text{HCl(aq)}$ ,  $\text{CH}_3\text{COOH(aq)}$ ,  $\text{NaOH(aq)}$  and  $\text{NH}_4\text{Cl(aq)}$  but not necessarily in the same order. The concentration and pH for each solution are shown below.

solution	concentration / mol dm <sup>-3</sup>	pH
<b>E</b>	1.0	4.0
<b>F</b>	1.0	5.8
<b>G</b>	0.01	12.0
<b>H</b>	0.01	2.0

Which statements are correct?

- 1 **E** contains a weak acid while **H** contains a strong acid.
- 2 Mixing 10 cm<sup>3</sup> of **E** and 500 cm<sup>3</sup> of **G** produces a buffer solution.
- 3 Mixing 10 cm<sup>3</sup> of **F** and 50 cm<sup>3</sup> of **H** produces a buffer solution

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

- 17** At a body temperature of 37 °C,  $K_w$  has a value of  $2.4 \times 10^{-14}$ .

What is the concentration of  $\text{OH}^-$  if the pH of blood is 7.4 under these conditions?

- A**  $3.98 \times 10^{-8} \text{ mol dm}^{-3}$       **B**  $6.03 \times 10^{-7} \text{ mol dm}^{-3}$   
**C**  $2.51 \times 10^{-7} \text{ mol dm}^{-3}$       **D**  $7.00 \times 10^{-7} \text{ mol dm}^{-3}$

- 18** The solubilities of  $\text{BaSO}_4$  and  $\text{PbSO}_4$  are  $x$  and  $y$   $\text{mol dm}^{-3}$  respectively at 298 K.

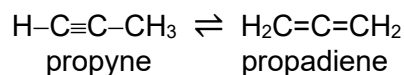
A solution saturated with both  $\text{BaSO}_4$  and  $\text{PbSO}_4$  was prepared by dissolving  $\text{BaSO}_4(\text{s})$  and  $\text{PbSO}_4(\text{s})$  in water at 298 K.

Which statements about the saturated solution are correct?

- 1  $[\text{SO}_4^{2-}] = (x + y) \text{ mol dm}^{-3}$
- 2  $[\text{Ba}^{2+}] < x \text{ mol dm}^{-3}$
- 3  $[\text{SO}_4^{2-}] = [\text{Ba}^{2+}] + [\text{Pb}^{2+}]$

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

- 19 A mixture of propyne and propadiene is produced as side products during the cracking of propane. Propyne exists in equilibrium with propadiene.



Which statement is **incorrect**?

- A** Propyne contains a  $\sigma$  bond formed by  $1s-2sp$  overlap.
- B** Propadiene contains a  $\pi$  bond formed by  $2p-2p$  overlap.
- C** Both propyne and propadiene contain  $sp$  hybridised carbons.
- D** Propyne has a longer C—C single bond compared to propane.
- 20 Ethers have the general structure  $R_1-O-R_2$  where  $R_1$  and  $R_2$  are hydrocarbon groups.
- What is the lowest number of carbon atoms an ether molecule must contain to have a chiral carbon atom?
- |            |            |
|------------|------------|
| <b>A</b> 5 | <b>B</b> 6 |
| <b>C</b> 7 | <b>D</b> 8 |
- 21 Which reactions will give a product mixture that rotates plane polarised light?
- |   |  |
|---|--|
| 1 | 1-bromohexane heated with alcoholic NaCN         |
| 2 | 3-bromo-3-methylhexane heated with aqueous NaOH  |
| 3 | Butanone reacted with HCN, trace amount of NaOH  |
| 4 | Cyclohexene with $\text{Br}_2$ in $\text{CCl}_4$ |
- |                       |                            |
|-----------------------|----------------------------|
| <b>A</b> 4 only       | <b>B</b> 1 and 3 only      |
| <b>C</b> 2 and 3 only | <b>D</b> None of the above |



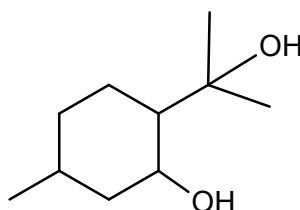
- 22 Compounds **P** to **S** have the same molecular formula  $C_7H_7X$ , where X can be Cl, Br or I.

Each compound was separately heated with ethanolic  $AgNO_3$  and the observations were recorded.

compound	observations
<b>P</b>	precipitate formed after 2 minutes
<b>Q</b>	no precipitate formed
<b>R</b>	precipitate formed instantaneously
<b>S</b>	precipitate formed after 10 minutes

Which statement about the compounds **P** to **S** is correct?

- A** The C—X bond length increases in the order **R** < **P** < **S** < **Q**.
- B** **R** can be formed by reacting  $Cl_2$  with methylbenzene in the presence of UV light.
- C** **Q** can be formed by reacting  $Br_2$  with methylbenzene in the presence of  $AlBr_3$ .
- D** Heating of each compound **P**, **Q**, **R** and **S** in acidified  $KMnO_4$  produces  $C_6H_5CO_2H$ .
- 23 Citriodiol is an active ingredient in insect repellent extracted from the lemon eucalyptus tree.



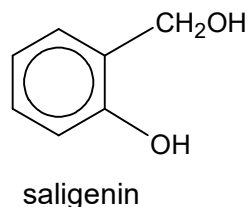
citriodiol

Citriodiol is heated under reflux with acidified potassium dichromate(VI) to form compound **E**.

Which reagent reacts with **both** citriodiol and compound **E**?

- A** alcoholic sodium hydroxide
- B** 2,4-dinitrophenylhydrazine
- C** warm alkaline aqueous iodine
- D** hot alumina

- 24 The structure of saligenin is shown.



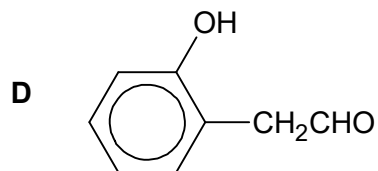
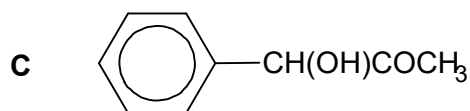
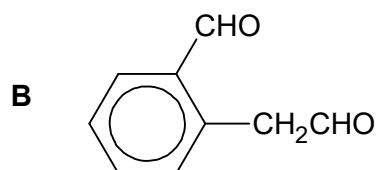
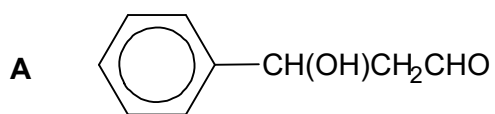
One mole of saligenin is separately reacted with an excess of sodium hydroxide and sodium.

Which row is correct?

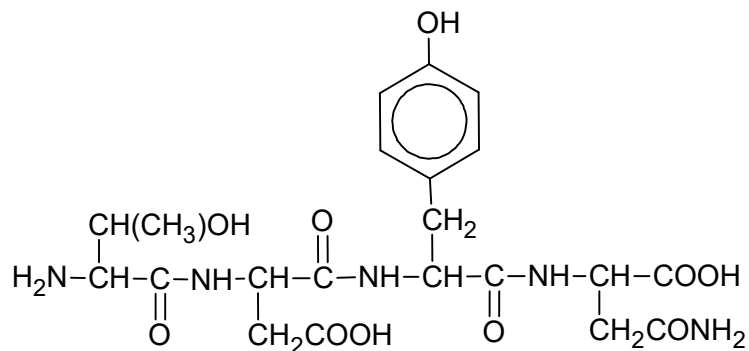
	moles of NaOH(aq) that react with one mole of saligenin	moles of H <sub>2</sub> produced when one mole of saligenin reacts with Na
<b>A</b>	0	1
<b>B</b>	1	2
<b>C</b>	1	1
<b>D</b>	2	2

- 25 When phosphorus pentachloride was added to an organic compound **P**, fumes of hydrogen chloride was evolved. When **P** was warmed with Fehling's solution, a red-brown precipitate was obtained.

Which of the following is likely to be compound **P**?



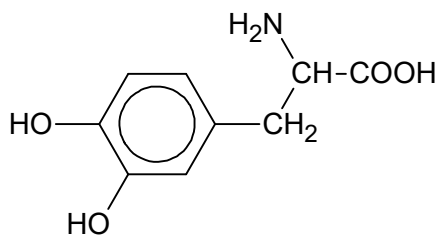
- 26 Compound **Z** is formed from the partial hydrolysis of a hormone molecule.



compound **Z**

Which statement is **incorrect**?

- A** Prolonged heating of **Z** with dilute NaOH produces three different carbon-containing products.
- B** Prolonged heating of **Z** with dilute NaOH liberates an alkaline gas.
- C** Two moles of  $\text{CH}_3\text{COCl}$  are needed for complete reaction with one mole of **Z**.
- D** One mole of  $\text{Na}_2\text{CO}_3$  is needed for complete reaction with one mole of **Z**.
- 27 Listening to music you enjoy releases the mood-enhancing chemical dopamine in your brain.

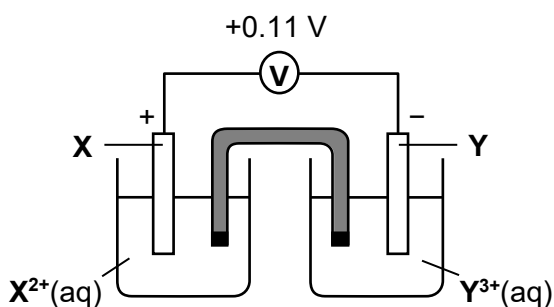


dopamine

Which of the following statements about dopamine are **false**?

- 1 It is soluble in water due to zwitterion formation.
- 2 It migrates to the cathode of an electrolytic cell at pH 14.
- 3 The acidity of dopamine will decrease when aqueous bromine is added.

- |                       |                       |
|-----------------------|-----------------------|
| <b>A</b> 1, 2 and 3   | <b>B</b> 1 and 2 only |
| <b>C</b> 1 and 3 only | <b>D</b> 2 and 3 only |



Which is the strongest reducing agent?

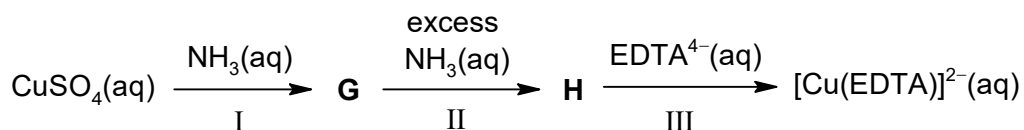
- |          |                       |  |          |                       |
|----------|-----------------------|--|----------|-----------------------|
| <b>A</b> | <b>X</b>              |  | <b>B</b> | <b>Y</b>              |
| <b>C</b> | <b>X<sup>2+</sup></b> |  | <b>D</b> | <b>Y<sup>3+</sup></b> |

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

When a current of 2.0 A was passed through a molten aluminium salt for 9.0 hours, what is the maximum mass of aluminium formed at the cathode?

- |          |        |          |        |
|----------|--------|----------|--------|
| <b>A</b> | 6.04 g | <b>B</b> | 18.1 g |
| <b>C</b> | 48.6 g | <b>D</b> | 54.4 g |

**30** A reaction scheme starting from aqueous copper(II) sulfate is shown below. Both **G** and **H** are copper-containing species.



Which statement is correct?

- A**  $\text{NH}_3$  is a ligand in reaction I.
- B** Reaction II is a redox reaction.
- C** H is a deep blue solution containing  $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]\text{SO}_4$ .
- D** The entropy of the system decreases when reaction III occurs.