NAME _____ CLASS _____

JURONG PIONEER JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATION 2025

CHEMISTRY **8873/01**

Higher 1

Paper 1 Multiple Choice Questions

18 September 2025
1 hour

Candidates answer on the Question paper.

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and exam index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** or **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 **13** printed pages and **3** blank pages.

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[Turn over

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

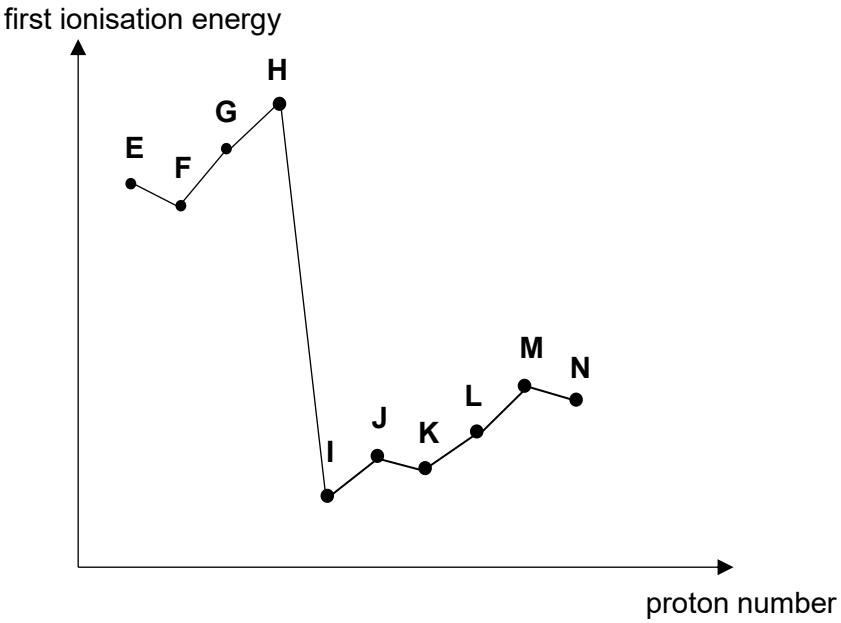
The atoms **X** and **Y** have the electronic configurations shown below.

X, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$; **Y**, $1s^2\ 2s^2\ 2p^5$

Which compound are they likely to form?

A X_2Y **B** XY **C** XY_2 **D** XY_4

2 The trend of first ionisation energy for 10 consecutive elements, in Period 2 and 3, is given below.



Which of the following statement is correct?

A Element **E** and **N** belong to the same group.
B **L** has a giant covalent structure.
C The oxide of **J** is amphoteric.
D The chloride of **I** is insoluble in water.

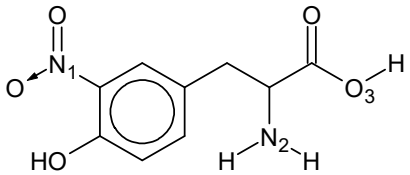
3 In which pair of molecules are both non–polar?

1 BeH_2 and SO_3
2 $AlCl_3$ and CH_4
3 PCl_5 And SCl_6

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

The following information is for Questions **4** and **5**.

Nitrotyrosine has been identified as an indicator for cell damage in the human body.



nitrotyrosine

4 What are the bond angles around N_1, N_2 and O_3 of nitrotyrosine?

	Bond angle / °		
	N_1	N_2	O_3
A	105	107	120
B	105	120	105
C	120	120	120
D	120	107	105

5 Which of the following functional groups can be found in nitrotyrosine?

You may refer to the structure above.

1 Amide
2 Amine
3 Carboxylic acid

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

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

	substance	structure	bonding
A	iodine	simple covalent	instantaneous dipole–induced dipole only
B	iron	giant metallic	ionic bonding only
C	sodium carbonate	giant ionic	ionic and covalent bonding
D	graphite	giant molecular	covalent bonding only

7 Arrange the following compounds in **ascending** order of boiling point.

Compound	Formula	M_r
P	$CH_3CH_2CH_2CH_3$	58
Q	CH_3COCH_3	58
R	$CH_3CH(CH_3)_2$	58
S	$CH_3CH_2CH_2OH$	60

A **P** → **Q** → **R** → **S**
B **Q** → **S** → **P** → **R**
C **R** → **P** → **Q** → **S**
D **S** → **P** → **R** → **Q**

8 Which of the following statements can be explained by the presence of intermolecular hydrogen bonding only.

1 Ice is less dense than water.
2 Dimerisation of ethanoic acid in hexane.
3 Dissolution of sodium chloride in water.

A 1 and 2 only
B 2 and 3 only
C 1 only
D 3 only

9 *Use of Data Booklet is relevant to this question.*

The maximum tolerable daily intake of ascorbic acid, also known as vitamin C, for adults is 2000 mg, beyond which there may be adverse effects on the human body.

What is the number of molecules in 2000 mg of ascorbic acid, $C_6H_8O_6$?

A 6.84×10^{18} **B** 1.20×10^{24}
C 6.84×10^{21} **D** 1.20×10^{27}

10 1 mol of acidified $Cr_2O_7^{2-}$ reacted with 3 mol of Mn^{2+}. The products are Cr^{3+} and a manganese cation, of an unknown oxidation state.

What is the oxidation state of the manganese cation?

A +3 **B** +4
C +5 **D** +6

11 Sodium azide, NaN_3, is the compound that inflates the airbags in a car in event of a collision. However, it produces sodium as a byproduct.

$$2NaN_3 \rightarrow 2Na + 3N_2$$

To ensure that the sodium does not add further injuries to people, potassium nitrate, KNO_3, is added in excess to the sodium azide.

$$10Na + 2KNO_3 \rightarrow K_2O + 5Na_2O + N_2$$

What is the volume of nitrogen gas, at r.t.p., obtained when an airbag, containing 0.100 mol of sodium azide, is activated?

A 1500 cm^3 **B** 1600 cm^3
C 3600 cm^3 **D** 3840 cm^3

12 The following statements describes the behaviour of an element, **T**, in Period 3 of the Periodic Table.

Three of the statements describing the behaviour of element **T** are true and one is false.

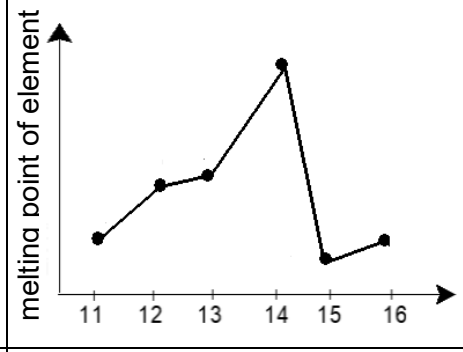
Which of the statements is false?

A **T** has a lower ionisation energy than the element before it.
B **T** has a larger atomic radius than the element after it.
C **T** forms an oxide that is insoluble in water.
D **T** can react with chlorine to form **T**Cl_5.

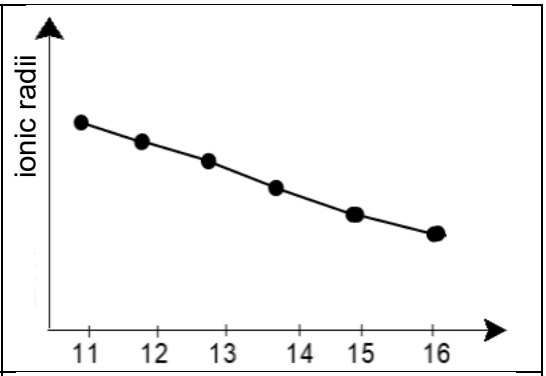
13 The properties of Period 3 elements and their compounds are plotted against increasing atomic number.

Which of the following graphs is **incorrect**?

A



B



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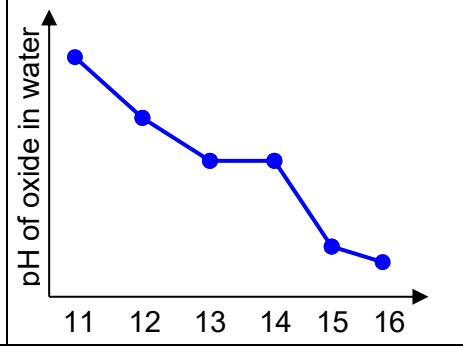
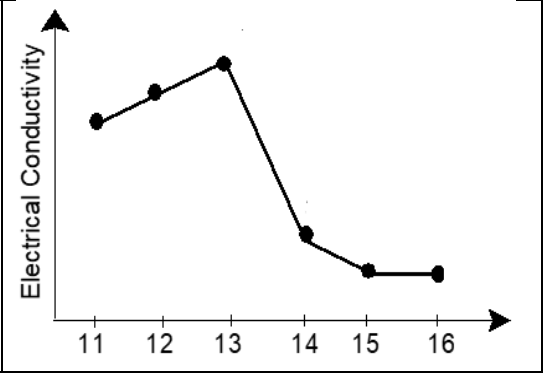


D



14 Which statements about Group 17 elements and their compounds are correct?

1 The first ionisation energy of the atoms decreases down the group.
2 The oxidising power of the halogens decreases down the group.
3 The boiling point of the hydrogen halides decreases down the group.

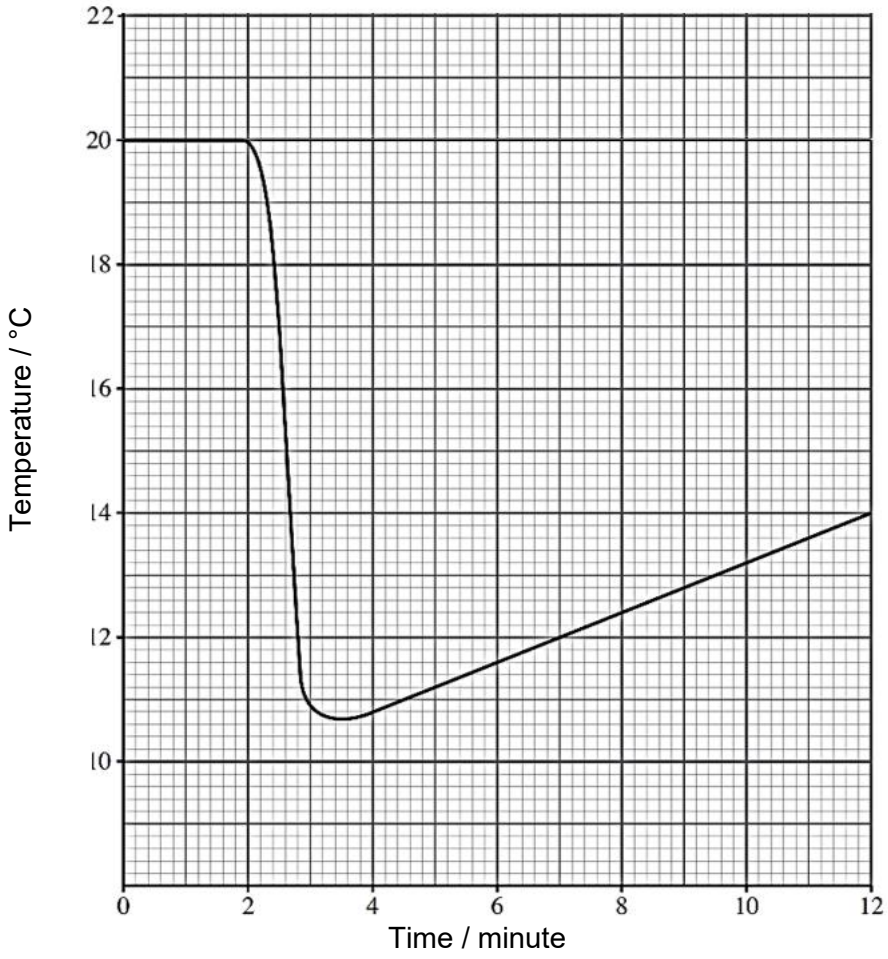
A 1, 2 and 3
B 1 and 2 only
C 2 and 3 only
D 1 only

15 Which equation corresponds to the enthalpy change stated?

A	$CH_4(g) \rightarrow C(g) + 4H(g)$	Bond energy(C–H)
B	$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$	$\Delta H^{\ominus}_{combustion}(H_2)$
C	$2Na(s) + C(s) + O_3(g) \rightarrow Na_2CO_3(s)$	$\Delta H^{\ominus}_{formation}(Na_2CO_3)$
D	$\frac{1}{2}H_2SO_4(aq) + \frac{1}{2}Ba(OH)_2(aq) \rightarrow \frac{1}{2}BaSO_4(aq) + H_2O(l)$	$\Delta H^{\ominus}_{neutralisation}$

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

An experiment was conducted to determine the enthalpy change of solution of ammonium nitrate, NH_4NO_3. A styrofoam cup was filled with 50.0 g of water and the temperature of the water was measured at intervals of 1 minute. At 2 minutes, 6.50 g of NH_4NO_3 was added and the temperature of the mixture was recorded every minute. The following graph was obtained.

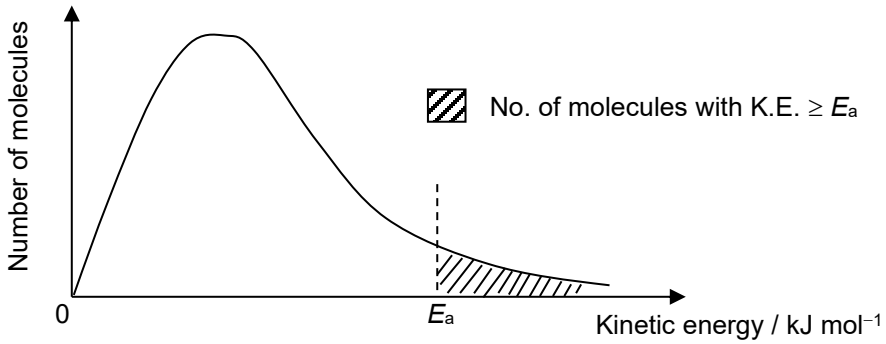


What is the enthalpy change of solution of ammonium nitrate, NH_4NO_3?

A -25.7 kJ mol^{-1} **B** -24.1 kJ mol^{-1}

C $+25.7$ kJ mol^{-1} **D** $+24.1$ kJ mol^{-1}

17 The graph shows the Boltzmann distribution for a sample of gas at 298 K.



Which of the following describes what would happen to the graph when a catalyst is added?

A The maxima of the graph shifts up.
B The maxima of the graph shifts to the left.
C The maxima of the graph shifts to the right.
D The maxima of the graph does not change.

18 In many countries, it is mandatory to install catalytic converters in motor vehicles to remove pollutants from the exhaust gases.

Which of these substances are not removed by the catalytic converters?

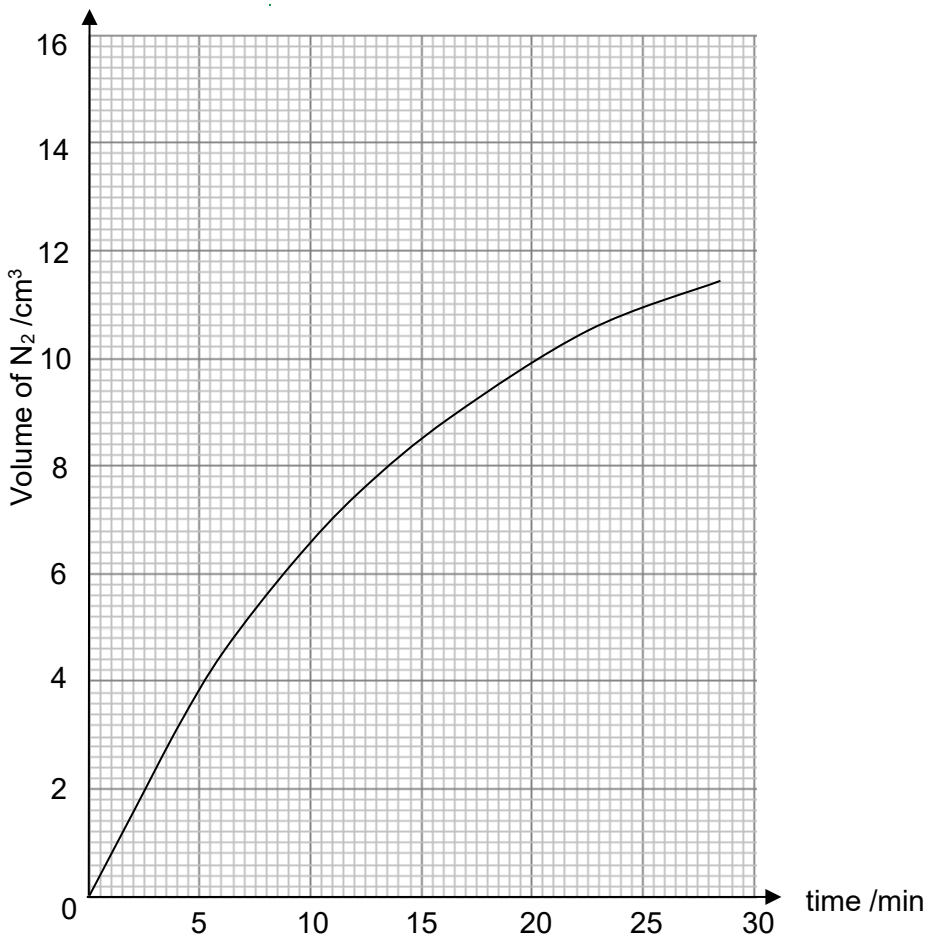
A CO
B CO_2
C NO_2
D C_8H_{18}

19 Ammonium nitrite decomposes according to the equation below.

$$NH_4NO_2(aq) \rightarrow N_2(g) + 2H_2O(l)$$

The kinetics of the decomposition of a 100 cm^3 sample of 5.50 x 10^{-3} mol dm^{-3} NH_4NO_2 sample was studied by measuring the volume of nitrogen gas produced, at r.t.p., at various time intervals.

A graph of volume of nitrogen gas against time was plotted, as shown below.



What is the half–life, determined from the graph above, and the order of reaction with respect to NH_4NO_2?

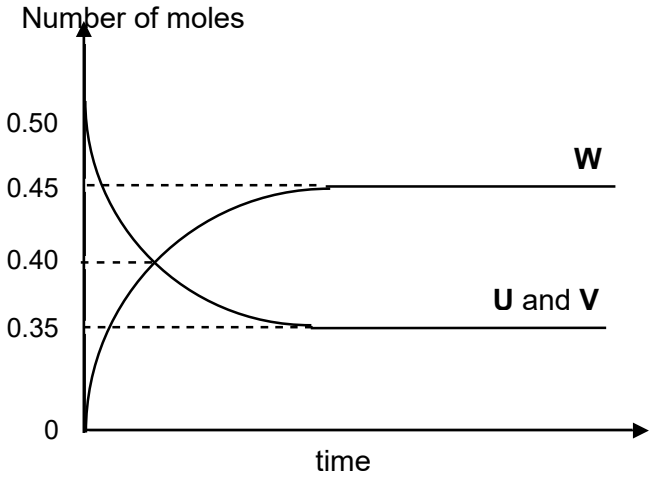
	Half–life / min	Order of reaction w.r.t. NH_4NO_2
A	10.0	0
B	13.8	0
C	10.0	1
D	13.8	1

20 Two gases, **U** and **V,** react as follows.

$$\mathbf{U}(g) + \mathbf{V}(g) \rightleftharpoons 3\mathbf{W}(g)$$

A mixture containing **U** and **V** is heated in a 2 dm^3 closed vessel and the reaction is allowed to reach equilibrium.

The following graph shows how the number of moles of each gas varies with time.



What is the value of the equilibrium constant K_c for this reaction?

A 0.372 **B** 0.744 **C** 1.35 **D** 2.69

21 Poly(tetrafluoroethene) is a polymer used as a coating in non-stick kitchen utensils and for replacement of bone joints. One of the stages in the manufacture of the polymer is shown in the equation below.

$$2CHClF_2(g) \rightleftharpoons C_2F_4(g) + 2HCl(g) \qquad \Delta H = +128 \text{ kJ mol}^{-1}$$

Which of the following conditions will shift this equilibrium to the right?

1 high temperature
2 low pressure
3 using catalyst

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

22 An enzyme, found in the stomach, operates at maximum efficiency when in an aqueous solution buffered at pH 5.

Which combination of substances, when dissolved in 1 dm^3 of water, would give the necessary acidic buffer solution?

A 2 mol of CH_3CO_2H and 1 mol of NaOH
B 1 mol of CH_3CO_2H and 2 mol of NaOH
C 1 mol of HC*l* and 1 mol of CH_3CO_2Na
D 2 mol of NH_3 and 1 mol of $CH_3CO_2NH_4$

23 20 cm^3 of 0.10 $moldm^{-3}$ of aqueous barium hydroxide, $Ba(OH)_2$ was mixed with 20 cm^3 of 0.10 $moldm^{-3}$ of aqueous hydrochloric acid. The following reaction occurs:

$$Ba(OH)_2(aq) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$$

What is the pH of the resulting solution?

A 1.30 **B** 2.60 **C** 11.4 **D** 12.7

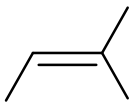
24 Values for the ionic product of water, K_w, at two different temperatures are given below.

temperature / ºC	K_w / $mol^2\ dm^{-6}$
25	1.00×10^{-14}
30	1.44×10^{-14}

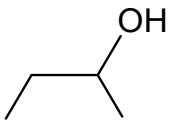
What of the following statement is **false**?

A The dissociation of water is an endothermic process.
B pH = 14 – pOH at 25 ºC.
C $[OH^-] = 1.00 \times 10^{-7}$ mol dm^{-3} at 25 ºC.
D Water is acidic at 30 ºC.

25 Which set of reagents and conditions can identify 2–methylbut–2–ene from butan–2–ol?



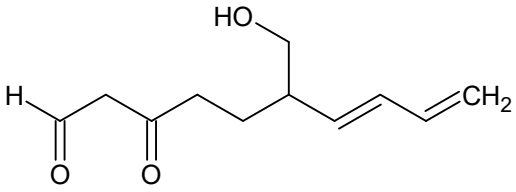
2–methylbut–2–ene



butan–2–ol

A $Br_2(aq)$
B H_2 gas, Ni
C LiA/H_4 in dry ether
D Hot excess concentrated H_2SO_4

26 Compound **X** reacts with hot acidified potassium dichromate.



Compound **X**

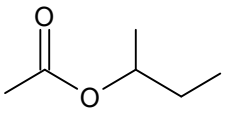
Which row correctly describes the number of cis–trans isomers and oxygen atoms in the organic product formed?

	number of cis–trans isomers	number of oxygen atoms
A	2	3
B	2	5
C	4	3
D	4	5

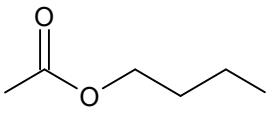
27 Ethanoic acid can react with butan–2–ol to form an ester.

Which of the following is the ester?

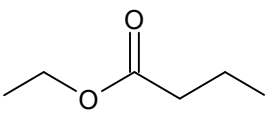
A



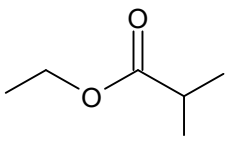
B



C



D



28 A lot of research has gone into developing superabsorbent polymers. The applications of these polymers include disposable diapers, to retain water in soil and even for creating artificial snow.

Which repeat unit best represents a condensation superabsorbent polymer?

A $-CH_2C(OH)_2-$
B –CHC*l*CHC*l*–
C $-NHCH(C_6H_5)CO-$
D –NHCH(OH)CH(OH)CO–

29 Which statement correctly describes the difference between low density poly(ethene), LDPE and high density poly(ethene), HDPE?

A LDPE has higher strength than HDPE.
B LDPE has a higher melting point than HDPE.
C LDPE chains have more branching than HDPE chains.
D LDPE chains can be packed tighter than HDPE chains.

30 In which contexts is surface area important?

1 prevention of atmospheric pollution using catalytic converters
2 the ability of a gecko to climb a wall.
3 high tensile strength of graphene

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

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