



CHEMISTRY

8872/01

Paper 1 Multiple Choice

15th September 2017
50 minutes

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.

1. Enter your NAME (as in NRIC). _____
2. Enter the SUBJECT TITLE. _____
3. Enter the TEST NAME. _____
4. Enter the CLASS. _____

Write your **name**
and **Civics Group**

Write and shade
your index number

WRITE		SHADE APPROPRIATE BOXES									
I N D E X N U M B E R	0	1	2	3	4	5	6	7	8	9	
	0	1	2	3	4	5	6	7	8	9	
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	0	1	2	3	4	5	6	7	8	9	
	0	1	2	3	4	5	6	7	8	9	
	A	B	C	D	E	F	G	H	I		

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 **13** printed pages.

Section A

Part 1

For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

- 1 The reaction between aluminium powder and anhydrous barium nitrate is used as the propellant in some fireworks. Nitrogen gas is one of the products formed.

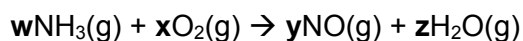
Which volume of nitrogen, measured under room conditions, is produced when 1 g of anhydrous barium nitrate reacts with an excess of aluminium?

- A** 86.9 cm³ **B** 91.8 cm³ **C** 174 cm³ **D** 184 cm³

- 2 Which statements about relative molecular mass are correct?

- A** It is the mass of one mole of the molecule.
B It is the ratio of the average mass of a molecule to the mass of a ¹²C atom.
C It is the sum of the relative atomic masses of all the atoms within the molecule.
D It is the mass of one mole of molecules on a scale where one atom of ¹²C has a mass of 12 units.

- 3 The first stage in the manufacturing of nitric acid is the oxidation of ammonia by oxygen.



Which values of **w**, **x**, **y** and **z** are needed to balance the equation?

	w	x	y	z
A	4	5	4	6
B	4	6	4	5
C	5	6	5	4
D	6	5	6	4

- 4 When beams of charged particles are pass through an electric field, they are deflected.

A stream of gaseous protons was passed between two oppositely charged plates and it deflected at an angle of 20.0° .

Under identical conditions, what angles and direction will He^{2+} be deflected?

	Angle of deflection	Deflected towards
A	5	Positive plate
B	10	Negative plate
C	20	Positive plate
D	40	Negative plate

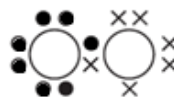
- 5 In the reaction shown, M represents a Group 2 element.



Which statement about this reaction is correct?

- A** It is a redox reaction.
- B** The anion in MO_2 contains 8 electrons.
- C** The lattice energy of MO_2 is greater in magnitude than the lattice energy of MO .

- D** The dot and cross diagram of the anion is



- 6 Which of the following species do not have all atoms that lie on the same plane?

- A** CH_2CH_2 **B** I_3^- **C** XeF_4 **D** BeCl_4^{2-}

- 7 In which pair of compounds does the first compound have higher boiling point than the second compound?

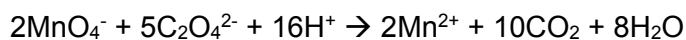
- A** HI , HF
- B** MgO , NaCl
- C** CH_4 , SiH_4
- D** *trans*- $\text{C}_2\text{H}_2\text{Cl}_2$, *cis*- $\text{C}_2\text{H}_2\text{Cl}_2$

- 8 A slow stream of water from a tap can be deflected by an electrostatically charged plastic rod because water is a polar molecule.

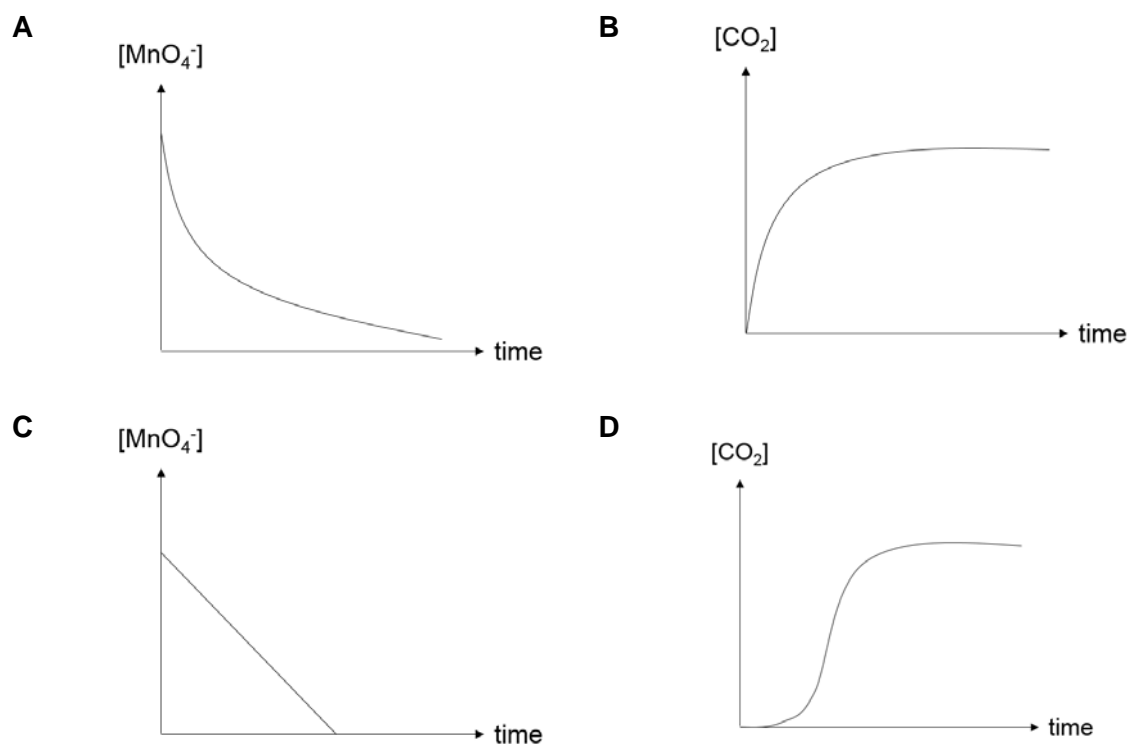


Why is a water molecule polar?

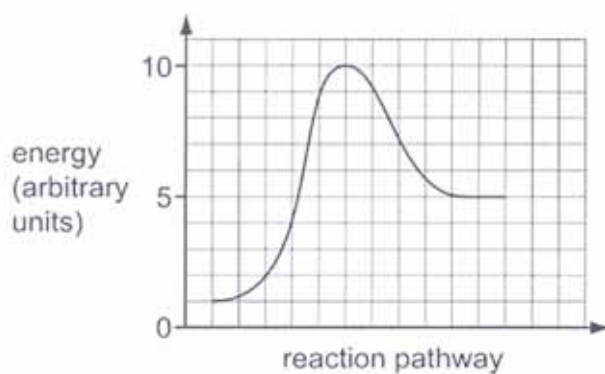
- A Water is able to dissociate into ions.
 B The oxygen atom has 2 lone pairs of electrons
 C Molecules are bonded together by hydrogen bonds.
 D The oxygen and hydrogen atoms have different electronegativities.
- 9 An autocatalytic reaction is one whereby the products catalyses the reaction. One such reaction is the reaction between ethanedioate and manganate(VII) anions.



Which of the following graphs would be obtained for an autocatalytic reaction?



- 10 The diagram shows the reaction pathway diagram for an uncatalysed reaction.



The reaction is then catalysed.

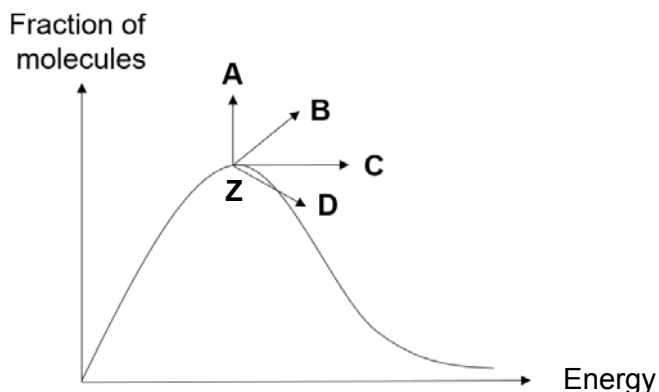
What are the changes in the rate constant and the reaction pathway diagram?

	rate constant	energy profile
A	decrease	
B	decrease	
C	increase	
D	increase	

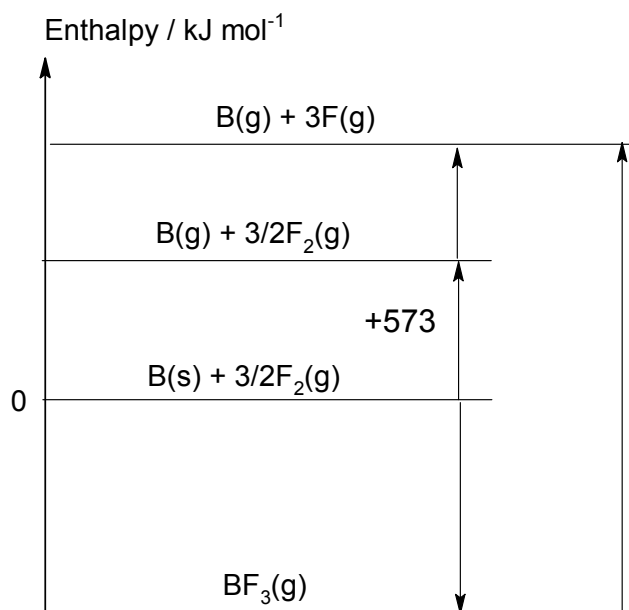
- 11 The following Maxwell-Boltzmann distribution curve shows the reaction when excess sodium carbonate reacts with 1 mol dm^{-3} hydrochloric acid at room temperature.

Point **Z** on the curve shows the most probable energy attained by the reactant molecules.

In which direction will point **Z** move when the same experiment is repeated with 2 mol dm^{-3} hydrochloric acid at 50°C ?



- 12 Reaction of boron hydride with fluorine is a vigorous process and is used as rocket propellant. The reaction yields gaseous boron fluoride, BF_3 , as one of the products. An energy level diagram involving BF_3 is shown below.



Given that the standard enthalpy change of formation of boron fluoride = $-1137 \text{ kJ mol}^{-1}$

Use the above information and appropriate data from the Data Booklet, calculate the bond energy of B-F bond.

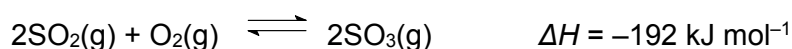
- A** 623 **B** 649 **C** 1869 **D** 1947

- 13 When 0.47 g of pentene was completely burnt in air, the heat produced raised the temperature of 200 g of water by 26.4 °C.

What is the enthalpy change of the reaction?

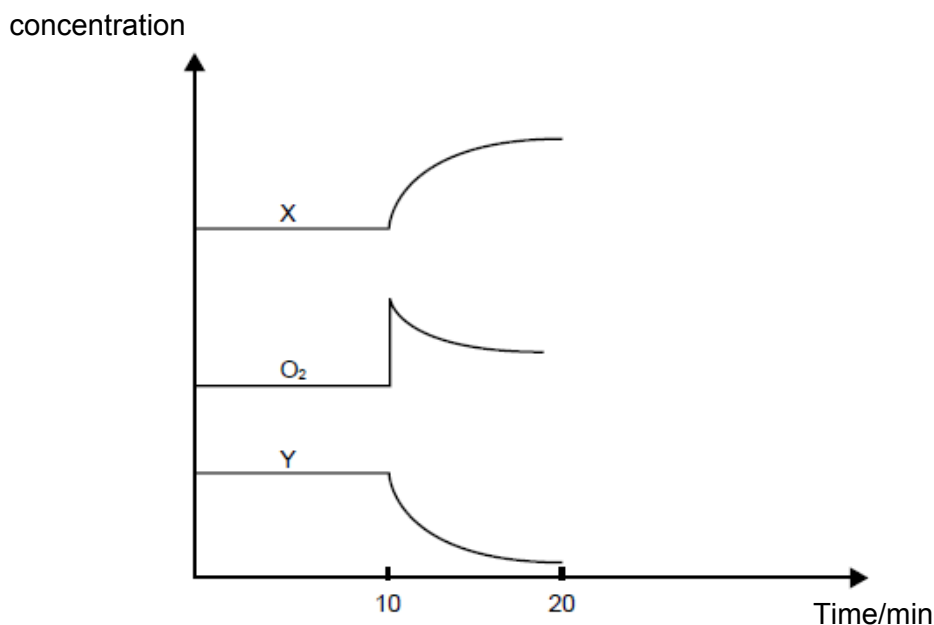
- A - 22 kJ mol⁻¹
- B - 3290 kJ mol⁻¹
- C - 3296 kJ mol⁻¹
- D - 3380 kJ mol⁻¹

- 14 Sulfur dioxide can be converted to sulfur trioxide.



A container was filled with an equilibrium mixture of sulfur dioxide, sulfur trioxide and oxygen in the presence of a catalyst. The container was initially at 450°C.

Concentrations during an experiment are shown on the diagram below.

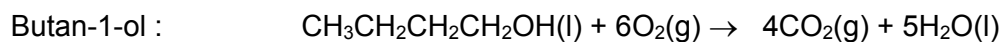
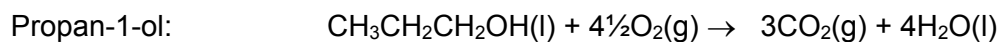
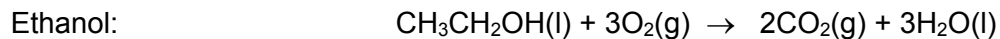


Which of the following correctly shows the change at the 10 minute point and the identities of X and Y?

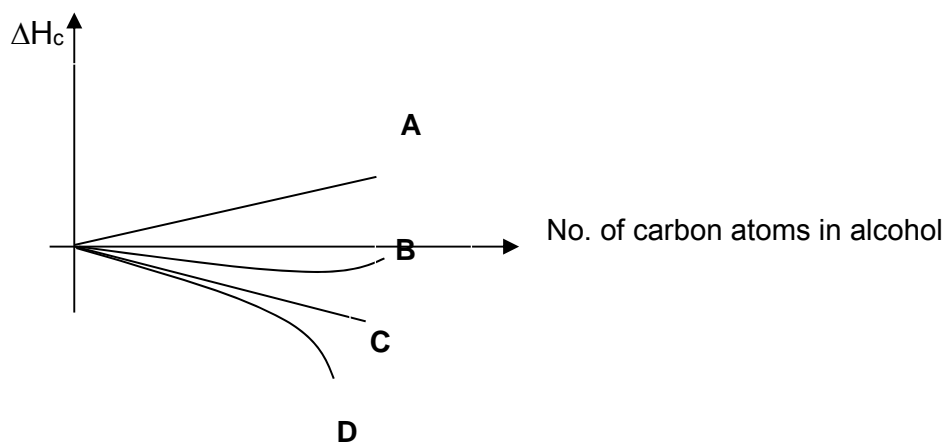
	X	Y	Change at the 10 min point
A	SO ₂	SO ₃	Temperature increases
B	SO ₃	SO ₂	Temperature increases
C	SO ₃	SO ₂	Oxygen was added
D	SO ₂	SO ₃	Oxygen was added

- 15 Which of the following could act as buffer solutions?
- A sodium hydrogen carbonate + sodium carbonate
 - B nitric acid + sodium nitrate
 - C sodium hydroxide + sodium chloride
 - D ethanoic acid + methylethanoate
- 16 Element Y is in Period 13 of the Periodic Table. The following four statements were made about the properties of element Y or its compounds.
- Three statements are correct descriptions and one is false.
- Which statement does **not** fit with the other three?
- A Element Y is a solid at room temperature.
 - B Element Y forms only one chloride when reacted with chlorine.
 - C The oxide of Y reacts with water to give an acidic solution.
 - D Adding NaOH(aq) to the solution resulting from the reaction of the chloride with water produces a white precipitate which is insoluble in excess of NaOH(aq).
- 17 For the elements in the third period of the Periodic Table, which property increases consistently from sodium to chlorine?
- A electronegativity
 - B electrical conductivity
 - C melting point
 - D first ionisation energy

- 18** The equations for the complete combustion of the first four members of the alcohol homologous series are shown below.

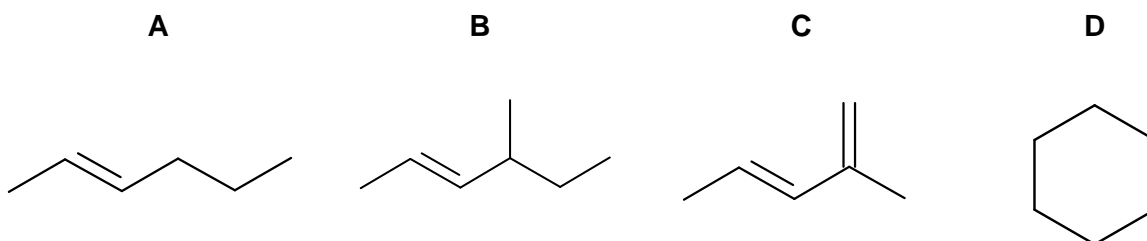


Which line on the graph shows the relationship between the number of carbon atoms in the alcohol and enthalpy change of combustion of the alcohol?

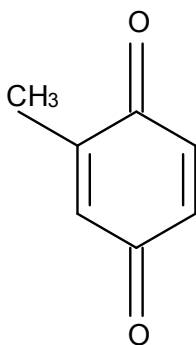


- 19** Use of the *Data Booklet* is relevant to this question.

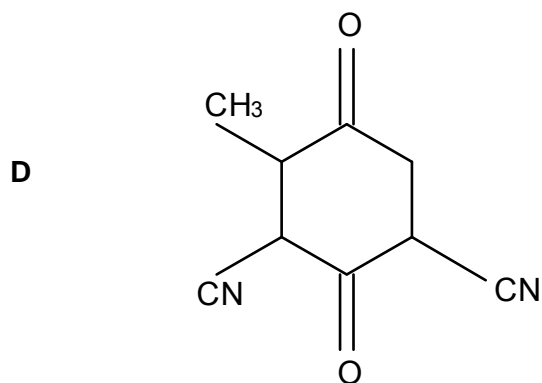
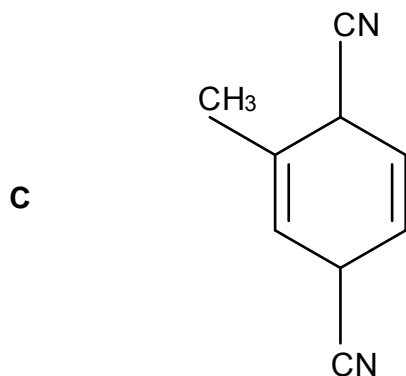
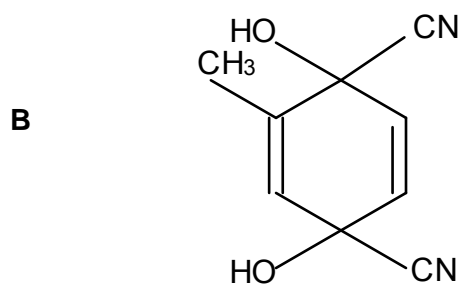
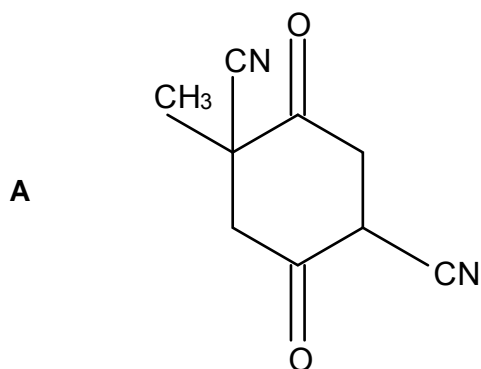
Which compound has a M_r of 84 and will react with HBr to give a product with an M_r of 164.9?



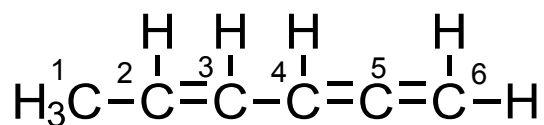
- 20 The unsaturated diketone shown is excreted by the bombardier beetle.



What is the compound formed when this compound reacts with hydrogen cyanide at 10-20°C?



21



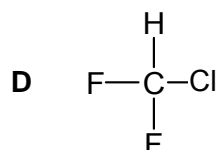
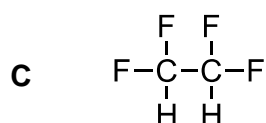
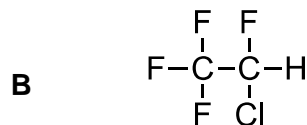
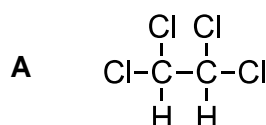
Which bond is present in the compound above?

- A** a σ bond formed by sp^3 - sp^3 overlap between C3 and C4
- B** a σ bond formed by sp^2 - sp overlap between C4 and C5
- C** a σ bond formed by sp^2 - sp^2 overlap between C5 and C6
- D** a π bond formed by sp^2 - sp^2 overlap between C2 and C3

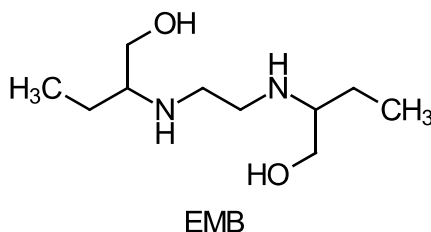
- 22 How many different alkenes are formed when 2-bromo-3-methylbutane reacts with ethanolic potassium hydroxide?

A 2 B 3 C 4 D 5

- 23 Which of the following will not damage the ozone layer through a radical chain reaction?



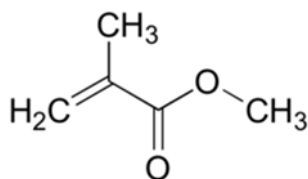
- 24 Ethambutol (EMB) is commonly used as first line drugs in tuberculosis treating regimes.



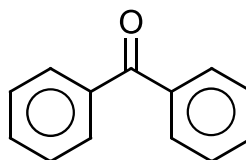
How many moles of hydrogen gas will be produced when one mole of EMB reacts with sodium?

A 1.0 B 2.0 C 3.0 D 4.0

- 25 Methyl methacrylate and benzophenone are common ingredients found in nail polishes.



Methyl methacrylate



Which of the following reagents cannot be used to distinguish between these two compounds?

- A Acidified $\text{K}_2\text{Cr}_2\text{O}_7$ B 2,4-dinitrophenylhydrazine
C Tollens' Reagent D Bromine water

SECTION B

For each of the questions in this section, one or more of the 3 numbered statements **1** to **3** may be correct.

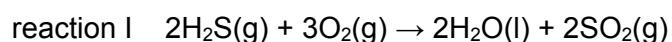
Decide whether each of the statements is or is not correct. (You may find it helpful to put a tick against the statements which you consider to be correct.)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1,2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

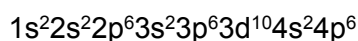
No other combination of statements is used as a correct response.

- 26** The Claus process recovers sulfur from the gaseous hydrogen sulfide found in raw natural gas and from the crude oil refinery by-product gases.



Which statement about the Claus process is correct?

- 1** H_2S is oxidised in the reaction.
 - 2** SO_2 is a reducing agent.
 - 3** Reaction II is a disproportionation reaction.
- 27** Which of the following have a solid lattice structure?
- 1** Ice
 - 2** Iodine
 - 3** Graphite
- 28** The following represents the electronic configuration of both a Group 2 cation and a Group 17 anion.



The radius of the anion is approximately twice that of the cation.

Which reasons explain the difference in size?

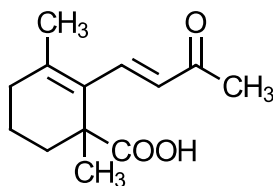
- 1** The cation has more protons than the anion.
- 2** There is more electron shielding in the anion than in the cation.
- 3** The anion is more electronegative than the cation.

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

No other combination of statements is used as a correct response.

- 29** Compound **Y** is a derivative of β -ionone, which is an important contributor of the aroma of roses.

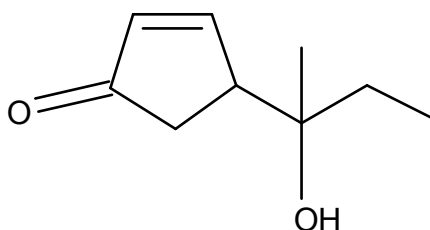


Compound **Y**

What is the correct number of H atoms incorporated per molecule of Compound **Y** when Compound **Y** is reacted with each of the following reducing agents?

	Reducing agent	Number of hydrogen atoms incorporated per molecule of Y
1	NaBH ₄ in ethanol	2
2	H ₂ / Ni	6
3	LiAlH ₄ in dry ether	8

- 30** Compound **Z** has the following structure:



Compound **Z**

Which of the following statements about compound **Z** is *incorrect*?

- It will give orange crystals with Brady's reagent.
- It is able to exhibit *cis trans* isomerism.
- It turns acidified potassium dichromate orange to green.

