



**SERANGOON JUNIOR COLLEGE**  
**General Certificate of Education Advanced Level**  
**Higher 1**

**CANDIDATE NAME**

**CLASS**

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**CHEMISTRY**

JC2 Preliminary Examination

**8872/01**

**29 August 2014**

Paper 1 Multiple Choice

**50 minutes**

Additional Materials:     Data Booklet  
                                     Optical Mark Sheet (OMS)

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**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

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

Write your name, FIN/NRIC number and class on the OMS in the spaces provided.

Shade correctly FIN/NRIC number and your class.

Eg. If your NRIC is S9306660Z, shade **S9306660Z** for the item “index number”.

There are **thirty** questions in 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 using a **soft pencil** on the separate OMS.

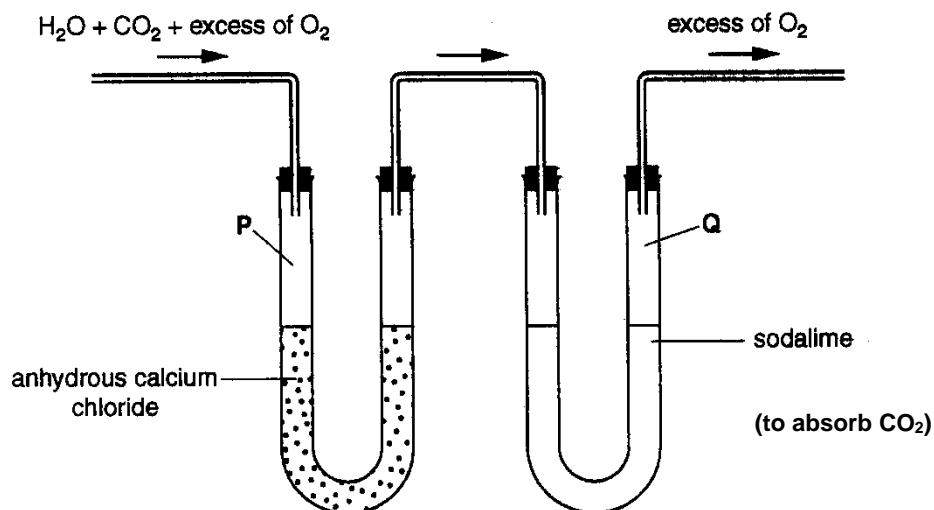
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

This document consists of **14** printed pages and **2** blank pages.

## Section A

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

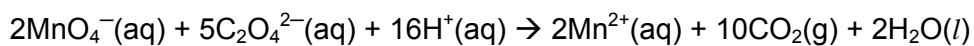
- 1 A sample of the hydrocarbon  $C_6H_{12}$  is completely burned in dry oxygen and the product gases are collected as shown. [ $A_r$ : H:1, C:12, O:16]



The increases in mass of the collecting vessels **P** and **Q** of the apparatus are  $M_P$  and  $M_Q$  respectively.

What is the ratio  $M_P / M_Q$  ?

- A** 0.41  
**B** 0.82  
**C** 1.20  
**D** 2.40
- 2 Ethanedioate ions,  $C_2O_4^{2-}$ , are oxidised by hot acidified, aqueous potassium manganate(VII) according to the following equation.

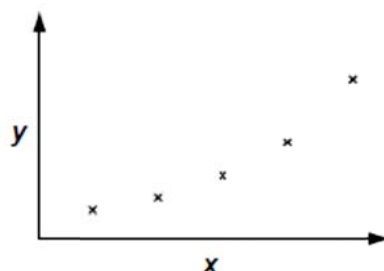


What volume of  $0.02 \text{ mol dm}^{-3}$  potassium manganate(VII) is required to oxidise completely  $1.0 \times 10^{-3} \text{ mol}$  of the salt  $KHC_2O_4 \cdot H_2C_2O_4$ ?

- A**  $20 \text{ cm}^3$   
**B**  $40 \text{ cm}^3$   
**C**  $50 \text{ cm}^3$   
**D**  $125 \text{ cm}^3$

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

The sketch graph shows the variation of one physical or chemical property with another for the Period 3 elements.



What are the correct labels for the axes?

	<b>x-axis</b>	<b>y-axis</b>
<b>A</b>	atomic number	mass number
<b>B</b>	atomic number	melting point
<b>C</b>	first ionisation energy	atomic number
<b>D</b>	first ionisation energy	atomic radius

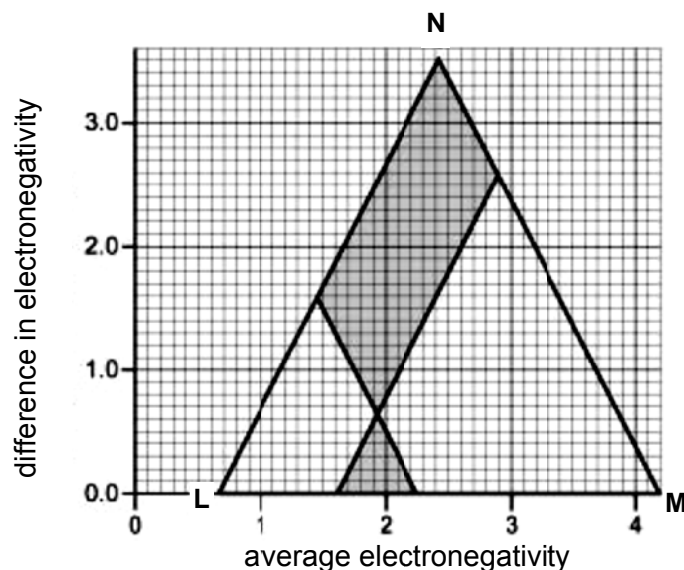
- 4 Use of *Data Booklet* is relevant to this question.

An ion  $\text{E}^{2+}$  contains 24 protons.

Which of the following statements about  $\text{E}^{2+}$  is **incorrect**?

- A** The enthalpy change for the reaction  $\text{E}(\text{g}) \rightarrow \text{E}^{2+}(\text{g}) + 2\text{e}^-$  is  $+2243 \text{ kJ mol}^{-1}$ .
- B** The angle of deflection of  $\text{E}^{2+}$  in an electric field is smaller than that of  $\text{E}^{3+}$ .
- C** The two electrons removed from  $\text{E}$  to form  $\text{E}^{2+}$  is from the 4s subshell.
- D**  $\text{E}^{2+}$  is isoelectronic with  $\text{Mn}^{3+}$ .

- 5 The type of bonding between two elements can be rationalised and even predicted using a van Arkel triangle. The triangle is based on electronegativity values. Difference in electronegativity is plotted along the y-axis and average electronegativity is plotted along the x-axis.



What is the type of bonding present at each of these bonding extremes, labelled **L**, **M** and **N** on the triangle?

	<b>L</b>	<b>M</b>	<b>N</b>
<b>A</b>	covalent	metallic	ionic
<b>B</b>	metallic	covalent	ionic
<b>C</b>	covalent	ionic	metallic
<b>D</b>	ionic	covalent	metallic

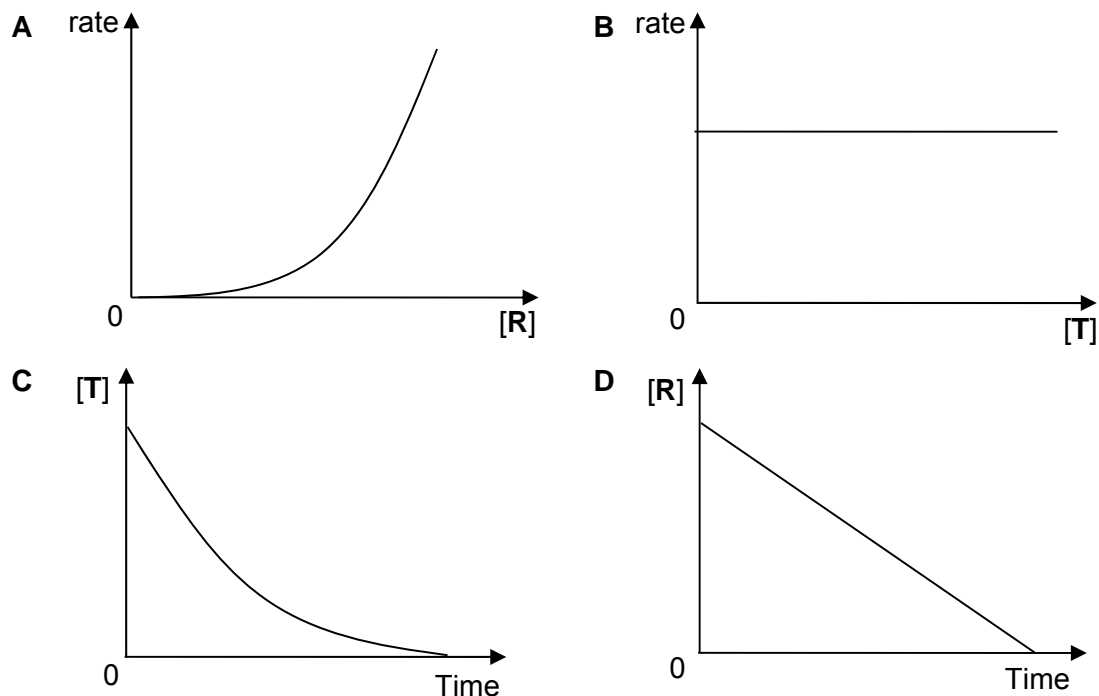
- 6 What is the total number of valence electrons used for  $\pi$ -bonding in  $\text{PO}_4^{3-}$ ?

- A** 2
- B** 4
- C** 6
- D** 8

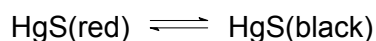
- 7 The rate equation for the reaction below is  $\text{rate} = k[\text{R}][\text{T}]$



Which of the following graphs is correct for the above reaction, when **T** is in excess?



- 8 Red mercury(II) sulfide is used as a red pigment which is known to darken and this has been ascribed to the equilibrium below.



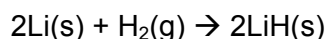
Data for each form of HgS are given in the table.

	$\Delta H_f^\theta$
red	$-58.2 \text{ kJ mol}^{-1}$
black	$-41000 \text{ J mol}^{-1}$

What is the standard enthalpy change of conversion of HgS?

- A  $0 \text{ kJ mol}^{-1}$
- B  $-17200 \text{ J mol}^{-1}$
- C  $-17.2 \text{ kJ mol}^{-1}$
- D  $+17.2 \text{ kJ mol}^{-1}$

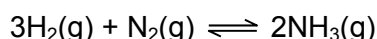
- 9 Lithium hydride is produced by reacting lithium metal with hydrogen gas:



The standard enthalpy change of formation of LiH can be measured in the laboratory and the atomisation energies of Li and H are given as **Z** and **W** kJ mol<sup>-1</sup> respectively.

What further information is required to calculate the lattice energy of LiH?

- A The hydrogen-hydrogen bond energy.
  - B The second ionisation energy of lithium.
  - C The first ionisation energy of lithium.
  - D Energy absorbed when electrons are lost from H(g) atoms.
- 10 Which of the following statements is **false**?
- A When an inert gas is added at constant volume to an equilibrium mixture, the equilibrium position of the system will not shift.
  - B The magnitude of the equilibrium constant shows the relative proportion of products to reactants, providing information on the reaction rate.
  - C When a system is in dynamic equilibrium, the concentration of reactants and products may not be equal.
  - D When a change in concentration is introduced to an equilibrium system, there is no change in the equilibrium constant.
- 11 The following shows the equilibrium reaction between hydrogen and nitrogen in the Haber process.



The forward and backward rate constants are given as  $k_1$  and  $k_{-1}$  respectively.

What will happen to  $k_1$ ,  $k_{-1}$ , and the equilibrium constant,  $K_p$ , if the pressure of the reaction vessel is decreased at constant temperature?

	$k_1$	$k_{-1}$	$K_p$
A	unchanged	unchanged	unchanged
B	decreases	increases	decreases
C	increases	increases	increases
D	increases	increases	unchanged

- 12 Stomach juices, mainly made up of hydrochloric acid, have a pH of 1.0. Aspirin is a weak monobasic acid, represented by HA, which dissociates into  $\text{H}^+$  and  $\text{A}^-$  ions.

What are the relative concentrations of  $\text{H}^+$ ,  $\text{A}^-$  and HA when aspirin from a tablet enters the stomach?

- A  $[\text{H}^+] > [\text{HA}] > [\text{A}^-]$   
 B  $[\text{HA}] > [\text{H}^+] = [\text{A}^-]$   
 C  $[\text{H}^+] > [\text{A}^-] > [\text{HA}]$   
 D  $[\text{H}^+] = [\text{A}^-] > [\text{HA}]$

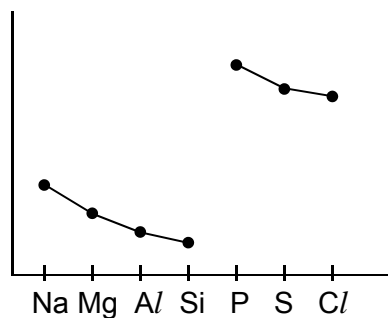
- 13  $\text{Na}_2\text{O}$ ,  $\text{Al}_2\text{O}_3$  and  $\text{P}_4\text{O}_{10}$  were dissolved separately in water and the pH of the resulting solutions was measured.

What is the order of increasing pH value of the resulting solutions formed by these oxides?

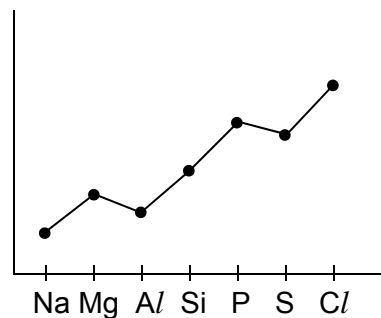
- A  $\text{Al}_2\text{O}_3$ ,  $\text{P}_4\text{O}_{10}$ ,  $\text{Na}_2\text{O}$   
 B  $\text{Al}_2\text{O}_3$ ,  $\text{Na}_2\text{O}$ ,  $\text{P}_4\text{O}_{10}$   
 C  $\text{Na}_2\text{O}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{P}_4\text{O}_{10}$   
 D  $\text{P}_4\text{O}_{10}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Na}_2\text{O}$

- 14 Which of the following sketches shows the correct trend in the stated property, for the elements in the third period of the Periodic Table?

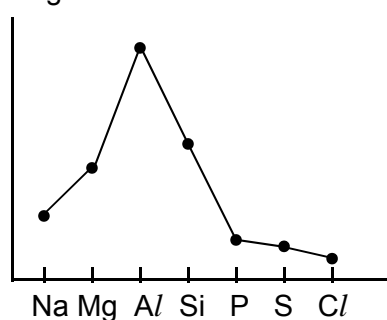
A Atomic Radius / nm



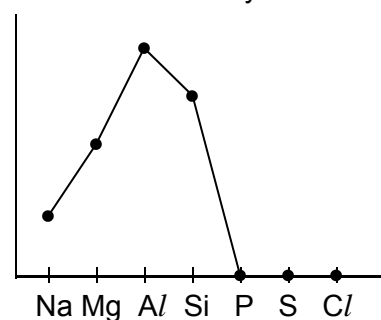
B First I.E /  $\text{kJ mol}^{-1}$



C Melting Point /  $^{\circ}\text{C}$



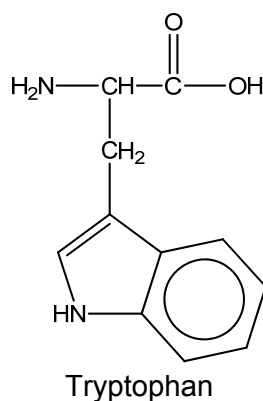
D Electrical Conductivity



- 15 Covalent bonds are formed by orbital overlap. The shape of unsaturated hydrocarbon molecules can be explained in terms of hybridisation of orbitals.

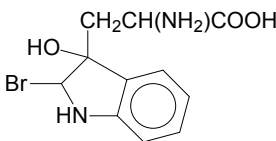
Which of the following bond is **not** present in  $\text{CH}_2=\text{C}=\text{CHCH}_2\text{CH}_3$ ?

- A a  $\pi$  bond formed by  $\text{sp}-\text{sp}^2$  overlap  
 B a  $\sigma$  bond formed by  $\text{sp}^3-\text{sp}^2$  overlap  
 C a  $\sigma$  bond formed by  $\text{s}-\text{sp}^3$  overlap  
 D a  $\sigma$  bond formed by  $\text{sp}^3-\text{sp}^3$  overlap
- 16 Tryptophan is an amino acid and is essential to the human diet. It also serves as a biological precursor to some chemicals associated with the nervous system of the human body.



What of the following statements is **not** true about tryptophan?  
 (Ignore the chemistry of  $\text{RNH}_2$  and  $\text{R}_2\text{NH}$  groups)

- A It contains amine, alkene and acid functional groups.

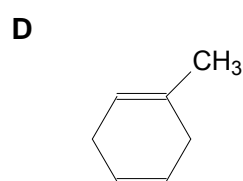
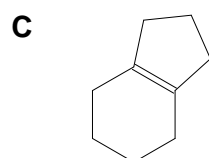
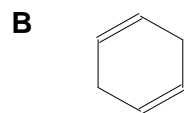
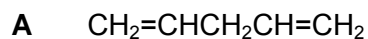
- B It reacts with aqueous bromine to form  as the major product.  
 C 1 mol of tryptophan reacts with sodium metal to give 0.5 mol of hydrogen gas.  
 D It exhibits cis-trans isomerism.

- 17 Which of the following is **not** a product in the reaction of methane with excess chlorine in the presence of ultraviolet light?

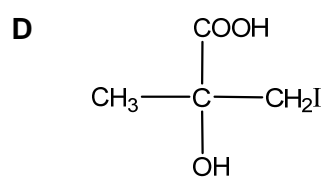
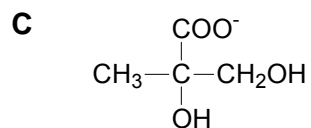
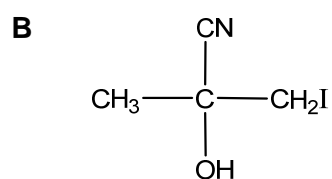
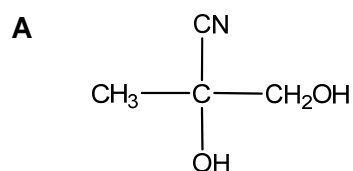
- A  $\text{H}_2$   
 B  $\text{HCl}$   
 C  $\text{CH}_3\text{Cl}$   
 D  $\text{CH}_2\text{Cl}_2$



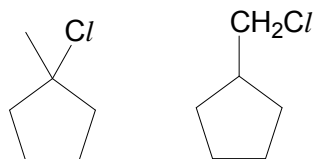
18 Which of the following compound forms two organic products when it is heated with acidified potassium manganate(VII) solution?



19 Which of the following is **not** a possible product when 1-iodopropanone reacts with hydrogen cyanide and sodium hydroxide?



- 20** Methylcyclopentane can react with chlorine via free radical substitution to produce a mixture of four monochlorinated products, two of which are shown below.



For methylcyclopentane, the order of reactivity of tertiary and primary hydrogen atoms follows a 5 : 1 ratio.

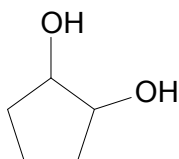
What is the likely ratio of tertiary  $\text{RCl}$  : primary  $\text{RCl}$  formed?

- A** 1 : 15  
**B** 1 : 3  
**C** 3 : 5  
**D** 5 : 3
- 21** *Use of the Data Booklet is relevant to this question.*

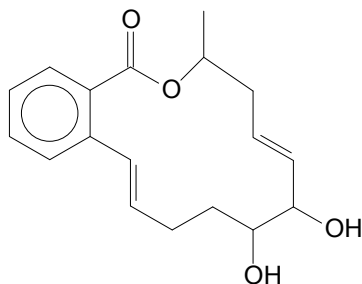
An organic liquid **Q** with molecular formula  $\text{C}_5\text{H}_{10}\text{O}_2$ , shows a broad absorption at  $3100\text{--}3500\text{cm}^{-1}$  in the infra-red spectrum. When **Q** reacts with acidified sodium dichromate(VI) solution, a liquid can be distilled from the reaction mixture. This liquid gives a positive test on warming with Fehling's solution.

Which of the following is the likely identity of compound **Q**?

- A**  $\text{CH}_3(\text{CH}_2)_3\text{CO}_2\text{H}$   
**B**  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{COCH}_3$   
**C**  $\text{HOCH}_2\text{CH}_2\text{COCH}_2\text{CH}_3$   
**D**



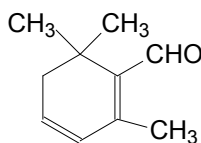
- 22 Research has shown that Aigialomycin D, a fungal metabolite, is capable of inhibiting crucial enzymes related to cancers.



Aigialomycin D

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

- A It reacts with hot, acidified  $K_2Cr_2O_7$  to give a diketone.
  - B It reacts with hot, alkaline aqueous iodine to give a yellow solid.
  - C It reacts with  $Br_2$  (aq) to incorporate up to 4 atoms of bromine in each molecule.
  - D It reacts with cold, dilute alkaline  $KMnO_4$  to give a product containing 8 oxygen atoms.
- 23 Safranal is a component of the yellow dyestuff saffron.



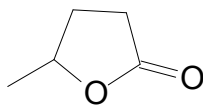
Safranal

What are the products formed when it is warmed with Tollens' reagent?

- A a precipitate of silver oxide and a carboxylate salt
  - B a silver mirror and a carboxylate salt
  - C a silver mirror and a carboxylic acid
  - D a silver mirror and an alcohol
- 24 Which pair of reactions *could* have the same common intermediate?
- W  $CH_3CH_2CH_3 \rightarrow \text{intermediate} \rightarrow (CH_3)_2CHCN$
  - X  $CH_3CH(OH)CH_3 \rightarrow \text{intermediate} \rightarrow (CH_3)_2C(OH)CN$
  - Y  $CH_3CH=CH_2 \rightarrow \text{intermediate} \rightarrow CH_3CH(OH)CH_3$
  - Z  $CH_3COOCH_2CH_2CH_3 \rightarrow \text{intermediate} \rightarrow CH_3CH_2CH_2Br$

- A W and X
- B W and Y
- C X and Z
- D Y and Z

- 25  $\gamma$ -Valerolactone is a naturally occurring organic compound found in fruits and could be a possible bio-fuel alternative to ethanol.



$\gamma$ -valerolactone

Which statement about this compound is **not** correct?

- A It is a cyclic ester.
- B It reacts readily with warm aqueous alkali.
- C It reacts with 2,4-dinitrophenylhydrazine to give an orange precipitate.
- D It can be prepared by warming 4-hydroxypentanoic acid,  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{COOH}$ , in the presence of an acid catalyst.

### Section B

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

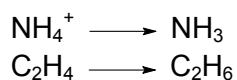
Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct).

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

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
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 to be used as correct response.

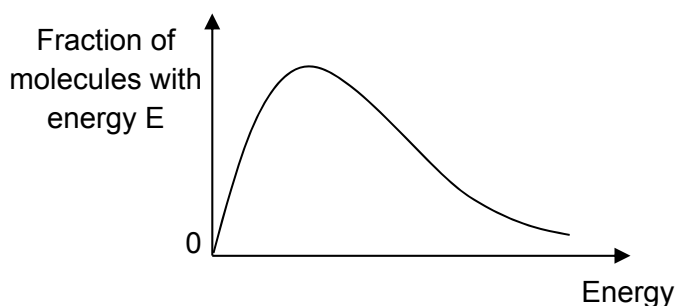
**26** Two conversions are outlined below.



What similar feature do these two conversions have?

- 1** decrease in bond angle of the species involved
- 2** change in oxidation state of an element
- 3** a lone pair of electrons in the product

**27** The diagram below represents the Boltzmann distribution of molecular energies at a given temperature.



With a temperature rise, which of the following statements are **incorrect**?

- 1** At all energies, the proportion of molecules increases.
- 2** The maximum of the curve is displaced upwards towards the right.
- 3** The proportion of molecules with energies above a given value increases.

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

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
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 to be used as correct response.

- 28** Which of the following indicators can be used for the titration between ethylamine and hydrochloric acid?

	<b>Indicator</b>	<b>pH transition range</b>
<b>1</b>	Naphtholphthalein	7.3 – 8.7
<b>2</b>	Congo red	3.0 – 5.0
<b>3</b>	Azolitmin	4.5 – 8.3

- 29** Bromine in tetrachloromethane is added separately to hexane, cyclohexene, benzene and methylbenzene.

Which of the following pairs would give the same observations?

<b>1</b>	hexane	benzene
<b>2</b>	hexane	cyclohexene
<b>3</b>	cyclohexene	methylbenzene

- 30** Methyl ethanoate undergoes acid hydrolysis in the presence of water labelled with the  $^{18}\text{O}$  isotope.

Which of the following products are formed?

- |          |  |
|----------|--|
| <b>1</b> | $\text{CH}_3\text{CO}^{18}\text{OH}$   |
| <b>2</b> | $\text{CH}_3^{18}\text{OH}$            |
| <b>3</b> | $\text{CH}_3\text{CH}_2^{18}\text{OH}$ |

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