



SERANGOON JUNIOR COLLEGE
General Certificate of Education Advanced Level
Higher 1

CANDIDATE NAME

CLASS

CHEMISTRY

JC2 Preliminary Examination

8872/01

29 August 2014

Paper 1 Multiple Choice

50 minutes

Additional Materials: Data Booklet
 Optical Mark Sheet (OMS)

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.

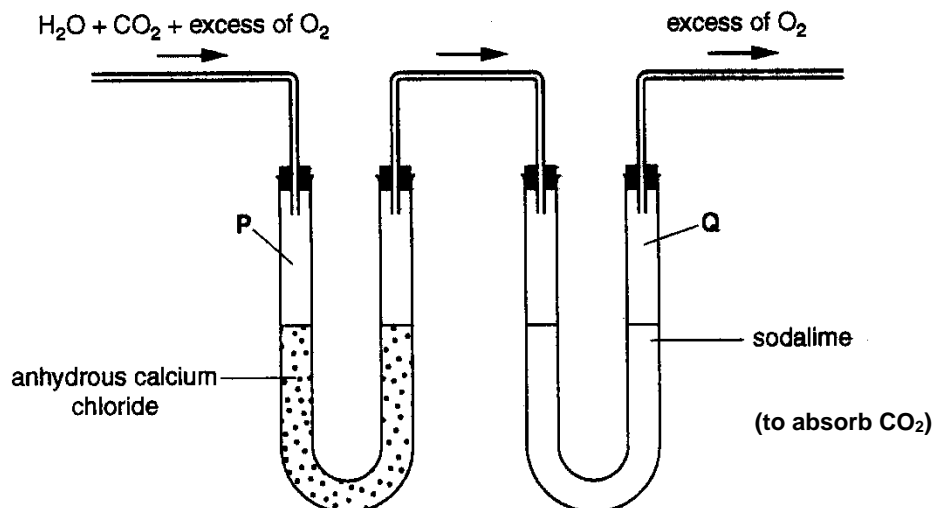
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

This document consists of **13** printed pages and **1** blank page.

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

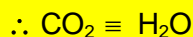
C 1.20

D 2.40

Answer: **A**



Complete combustion:



Increase in mass of collecting vessels **P**, M_p = mass of 1 mol of H_2O = **18g**

Increase in mass of collecting vessels **Q**, M_Q = mass of 1 mol of CO_2 = **44g**

Ratio, M_p / M_Q = 0.409 \approx 0.41

2	<p>Ethanedioate ions, $\text{C}_2\text{O}_4^{2-}$, are oxidised by hot acidified, aqueous potassium manganate(VII) according to the following equation.</p> $2\text{MnO}_4^-(\text{aq}) + 5\text{C}_2\text{O}_4^{2-}(\text{aq}) + 16\text{H}^+(\text{aq}) \rightarrow 2\text{Mn}^{2+}(\text{aq}) + 10\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$ <p>What volume of 0.02 mol dm^{-3} potassium manganate(VII) is required to oxidise completely $1.0 \times 10^{-3} \text{ mol}$ of the salt $\text{KHC}_2\text{O}_4 \cdot \text{H}_2\text{C}_2\text{O}_4$?</p>		
	<table border="1"> <tr> <td data-bbox="263 499 327 539">A</td> <td data-bbox="327 499 1423 539">20 cm^3</td> </tr> </table>	A	20 cm^3
A	20 cm^3		
	<table border="1"> <tr> <td data-bbox="263 539 327 580">B</td> <td data-bbox="327 539 1423 580">40 cm^3</td> </tr> </table>	B	40 cm^3
B	40 cm^3		
	<table border="1"> <tr> <td data-bbox="263 580 327 620">C</td> <td data-bbox="327 580 1423 620">50 cm^3</td> </tr> </table>	C	50 cm^3
C	50 cm^3		
	<table border="1"> <tr> <td data-bbox="263 620 327 654">D</td> <td data-bbox="327 620 1423 654">125 cm^3</td> </tr> </table>	D	125 cm^3
D	125 cm^3		

Answer: **B**



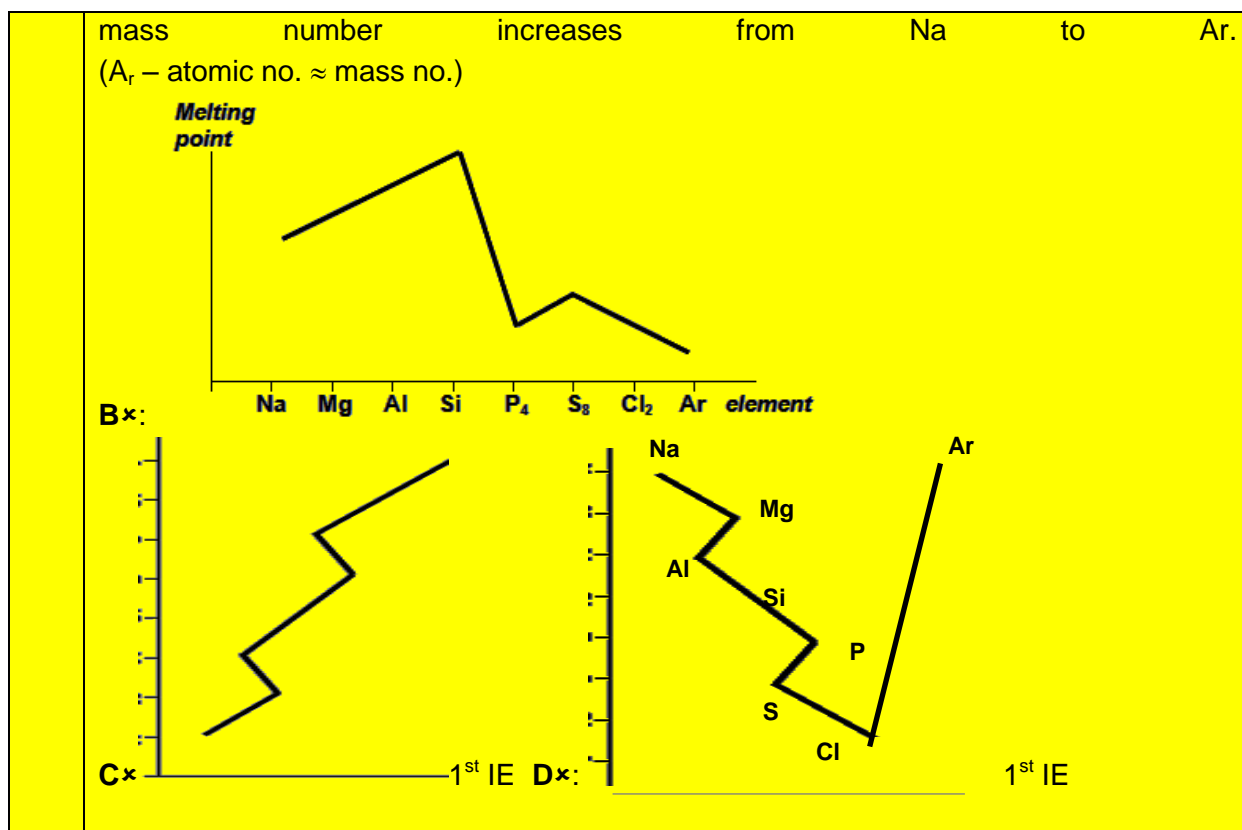
$$\text{Amount of } \text{C}_2\text{O}_4^{2-} = 2.0 \times 10^{-3} \text{ mol}$$



$$\text{Amount of } \text{MnO}_4^- = \frac{2.0 \times 10^{-3}}{5} \times 2 = 8.0 \times 10^{-4} \text{ mol}$$

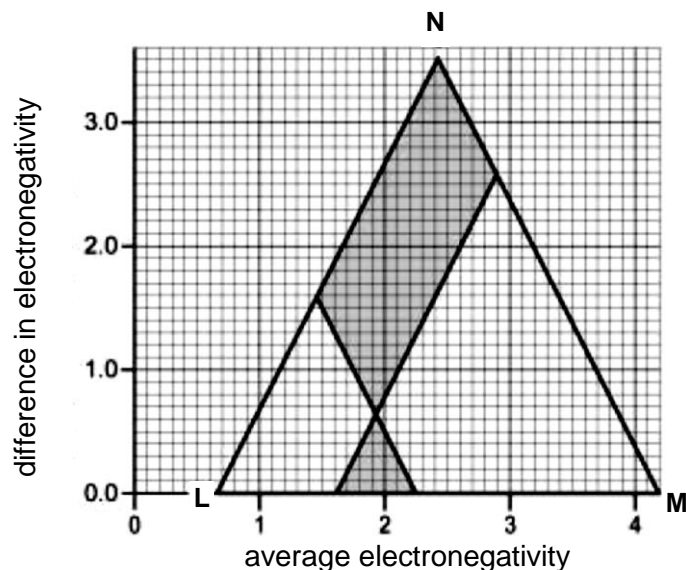
$$\text{Volume of } \text{MnO}_4^- \text{ needed} = \frac{8.0 \times 10^{-4}}{0.02} = \underline{\underline{40 \text{ cm}^3}}$$

3	<p>Use of the <i>Data Booklet</i> is relevant to this question.</p> <p>The sketch graph shows the variation of one physical or chemical property with another for the Period 3 elements.</p> <div data-bbox="644 1375 1026 1644" data-label="Figure"> </div> <p>What are the correct labels for the axes?</p>			
	<table> <tr> <td></td><th data-bbox="325 1756 876 1796">x-axis</th><th data-bbox="876 1756 1417 1796">y-axis</th></tr> </table>		x-axis	y-axis
	x-axis	y-axis		
	<table> <tr> <td data-bbox="261 1796 325 1836">A</td><td data-bbox="325 1796 876 1836">atomic number</td><td data-bbox="876 1796 1417 1836">mass number</td></tr> </table>	A	atomic number	mass number
A	atomic number	mass number		
	<table> <tr> <td data-bbox="261 1836 325 1877">B</td><td data-bbox="325 1836 876 1877">atomic number</td><td data-bbox="876 1836 1417 1877">melting point</td></tr> </table>	B	atomic number	melting point
B	atomic number	melting point		
	<table> <tr> <td data-bbox="261 1877 325 1917">C</td><td data-bbox="325 1877 876 1917">first ionisation energy</td><td data-bbox="876 1877 1417 1917">atomic number</td></tr> </table>	C	first ionisation energy	atomic number
C	first ionisation energy	atomic number		
	<table> <tr> <td data-bbox="261 1917 325 1957">D</td><td data-bbox="325 1917 876 1957">first ionisation energy</td><td data-bbox="876 1917 1417 1957">atomic radius</td></tr> </table>	D	first ionisation energy	atomic radius
D	first ionisation energy	atomic radius		
	<p>Answer: A</p>			



4	<p>Use of Data Booklet is relevant to this question.</p> <p>An ion E^{2+} contains 24 protons.</p> <p>Which of the following statements about E^{2+} is incorrect?</p>
A	The enthalpy change for the reaction $E(g) \rightarrow E^{2+}(g) + 2e$ is $+2243 \text{ kJ mol}^{-1}$.
B	The angle of deflection of E^{2+} in an electric field is smaller than that of E^{3+} .
C	The two electrons removed from E to form E^{2+} is from the 4s subshell.
D	E^{2+} is isoelectronic with Mn^{3+} .
	<p>Answer: C</p> <p>E is chromium.</p> <p>Cr: $[Ar] 3d^5 4s^1$ Cr^{2+}: $[Ar] 3d^4$</p> <p>The removal of electrons are from the 4s and 3d orbitals.</p>

- 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?

	L	M	N	
A	covalent	metallic	ionic	
B	metallic	covalent	ionic	
C	covalent	ionic	metallic	
D	ionic	covalent	metallic	

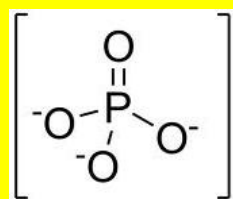
Answer: B

Difference in EN is zero for **L** & **M** \Rightarrow metallic bonding or covalent bonding.
Since metals have low electronegativity \Rightarrow **L** is metallic bonding.

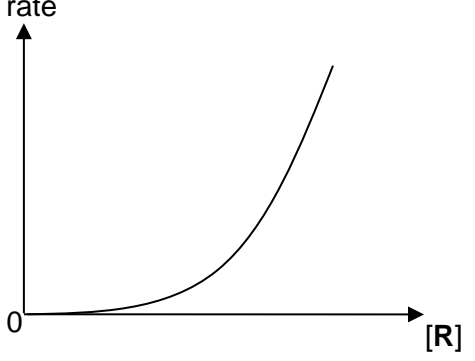
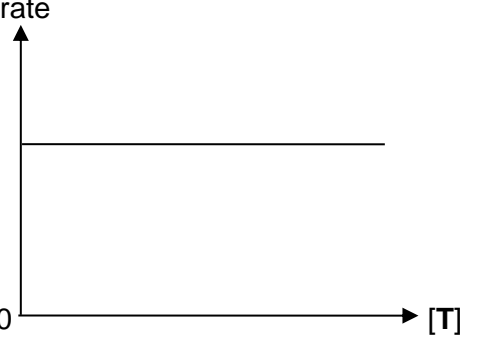
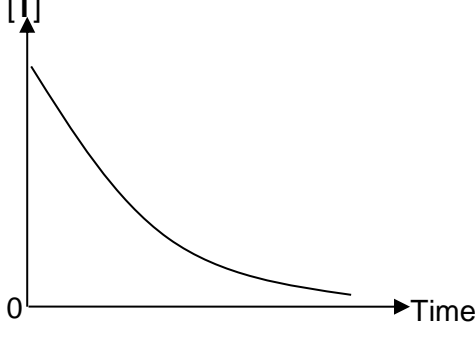
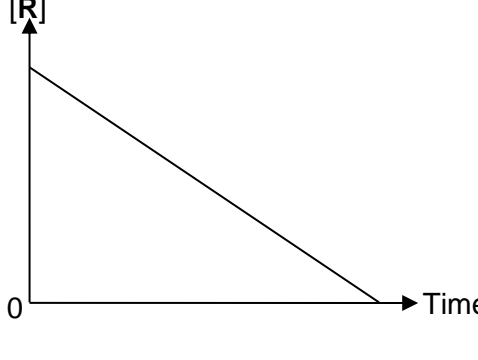
- 6 What is the total number of valence electrons used for π -bonding in PO_4^{3-} ?

- A** 2
B 4
C 6
D 8

Answer: A

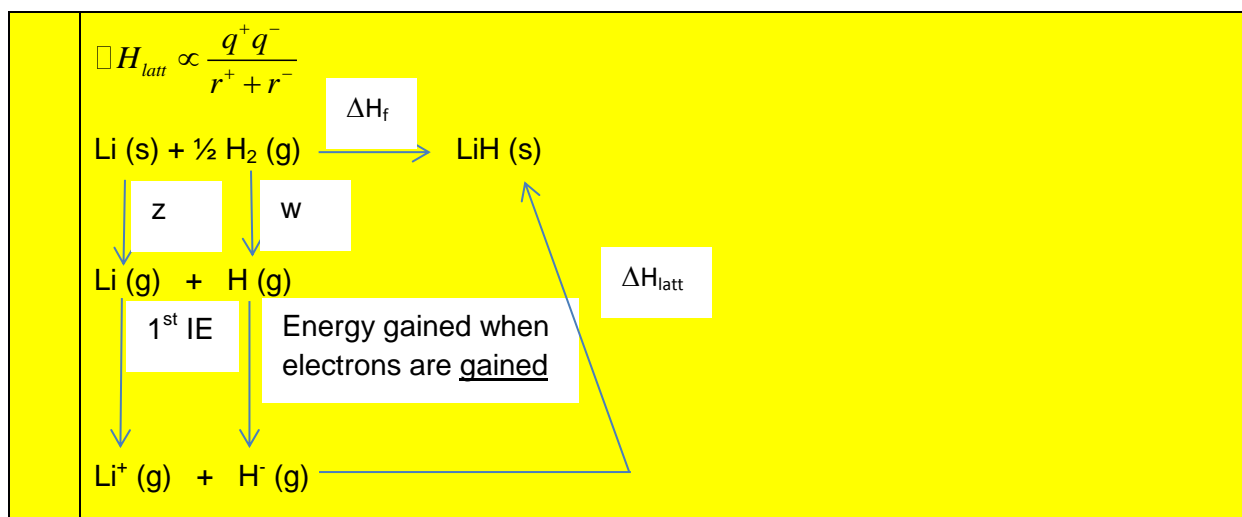


Each covalent bond involves 2 electrons.
 Each double bond comprises of one sigma (σ) and one π bond.
 Since only one π -bonding in PO_4^{3-}
 \Rightarrow 2 electrons used.

7	The rate equation for the reaction below is $\text{rate} = k[\text{R}][\text{T}]$			
$\text{U} + \text{R} + \text{T} \rightarrow \text{J} + \text{K}$				
Which of the following graphs is correct for the above reaction, when T is in excess?				
A		B		
C		D		
<p>Answer: B</p> <p>B is correct. If T is in excess, the rate = $k'[\text{R}]$, where $k' = k[\text{T}]$.</p> <p>A and D are incorrect (A should be upward sloping straight line; D should be a downward sloping curve). Pseudo-order first order reaction wrt R.</p> <p>C is incorrect (should be horizontal straight line). Zero order wrt to T since T is in excess.</p>				

8	<p>Red mercury(II) sulfide is used as a red pigment which is known to darken and this has been ascribed to the equilibrium below.</p> $\text{HgS}(\text{red}) \rightleftharpoons \text{HgS}(\text{black})$ <p>Data for each form of HgS are given in the table.</p> <table border="1" data-bbox="373 461 858 609"> <thead> <tr> <th></th><th>ΔH_f^θ</th></tr> </thead> <tbody> <tr> <td>red</td><td>$-58.2 \text{ kJ mol}^{-1}$</td></tr> <tr> <td>black</td><td>$-41000 \text{ J mol}^{-1}$</td></tr> </tbody> </table> <p>What is the standard enthalpy change of conversion of HgS?</p>		ΔH_f^θ	red	$-58.2 \text{ kJ mol}^{-1}$	black	$-41000 \text{ J mol}^{-1}$
	ΔH_f^θ						
red	$-58.2 \text{ kJ mol}^{-1}$						
black	$-41000 \text{ J mol}^{-1}$						
	<table border="1"> <tr> <td>A</td><td>0 kJ mol^{-1}</td></tr> </table>	A	0 kJ mol^{-1}				
A	0 kJ mol^{-1}						
	<table border="1"> <tr> <td>B</td><td>$-17200 \text{ J mol}^{-1}$</td></tr> </table>	B	$-17200 \text{ J mol}^{-1}$				
B	$-17200 \text{ J mol}^{-1}$						
	<table border="1"> <tr> <td>C</td><td>$-17.2 \text{ kJ mol}^{-1}$</td></tr> </table>	C	$-17.2 \text{ kJ mol}^{-1}$				
C	$-17.2 \text{ kJ mol}^{-1}$						
	<table border="1"> <tr> <td>D</td><td>$+17.2 \text{ kJ mol}^{-1}$</td></tr> </table>	D	$+17.2 \text{ kJ mol}^{-1}$				
D	$+17.2 \text{ kJ mol}^{-1}$						
	<p>Answer: D</p> <p> $\text{HgS}(\text{red}) \rightleftharpoons \text{HgS}(\text{black})$ $\Delta H_r^\theta = \Delta H_f^\theta(\text{black}) - \Delta H_f^\theta(\text{red})$ $= -41000/1000 - (-58.2)$ $= +17.2 \text{ kJ mol}^{-1} \text{ or } +17200 \text{ J mol}^{-1}$ </p>						

9	<p>Lithium hydride is produced by reacting lithium metal with hydrogen gas:</p> $2\text{Li}(\text{s}) + \text{H}_2(\text{g}) \rightarrow 2\text{LiH}(\text{s})$ <p>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^{-1} respectively.</p> <p>What further information is required to calculate the lattice energy of LiH?</p>		
	<table border="1"> <tr> <td>A</td><td>The hydrogen-hydrogen bond energy.</td></tr> </table>	A	The hydrogen-hydrogen bond energy.
A	The hydrogen-hydrogen bond energy.		
	<table border="1"> <tr> <td>B</td><td>The second ionisation energy of lithium.</td></tr> </table>	B	The second ionisation energy of lithium.
B	The second ionisation energy of lithium.		
	<table border="1"> <tr> <td>C</td><td>The first ionisation energy of lithium.</td></tr> </table>	C	The first ionisation energy of lithium.
C	The first ionisation energy of lithium.		
	<table border="1"> <tr> <td>D</td><td>Energy absorbed when electrons are lost from H(g) atoms.</td></tr> </table>	D	Energy absorbed when electrons are lost from H(g) atoms.
D	Energy absorbed when electrons are lost from H(g) atoms.		
	<p>Answer: C</p>		



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.
<p>Answer: B</p> <p>Option A : When an inert gas is added at constant volume to an equilibrium mixture, the equilibrium position of the system will not shift. This is because the inert gas added increases the total pressure of the system, but does not change the partial pressures of the reacting gases.</p> <p>Option B: The magnitude of the equilibrium constant informs us of the relative proportion of products to reactants, providing us information on the <u>extent of reaction</u>.</p> <p>Option C: When a system is in dynamic equilibrium, the concentration of reactants and products may not be equal. When dynamic equilibrium is reached, the rate of the forward and backward reaction is equal.</p> <p>Option D: When a change in concentration is introduced to an equilibrium system, <u>only</u> the concentration of reactants and products changes. K_c is temperature dependent.</p>	

11	The following shows the equilibrium reaction between hydrogen and nitrogen in the Haber process. $3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ 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	
Answer: A Rate constants are only affected by catalyst and equilibrium constants are affected by temperature.					

12	<p>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 H^+ and A^- ions.</p> <p>What are the relative concentrations of H^+, A^- and HA when aspirin from a tablet enters the stomach?</p>
	A $[\text{H}^+] > [\text{HA}] > [\text{A}^-]$
	B $[\text{HA}] > [\text{H}^+] = [\text{A}^-]$
	C $[\text{H}^+] > [\text{A}^-] > [\text{HA}]$
	D $[\text{H}^+] = [\text{A}^-] > [\text{HA}]$
	<p>Answer: A</p> <p>Since stomach juice has a pH of 1.0, $[\text{H}^+]$ will be higher than that of $[\text{HA}]$. HA is a weak acid, hence degree of dissociation is low and $[\text{HA}]$ will be larger than $[\text{A}^-]$.</p>

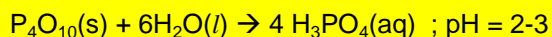
13	<p>Na_2O, Al_2O_3 and P_4O_{10} were dissolved separately in water and the pH of the resulting solutions was measured.</p> <p>What is the order of increasing pH value of the resulting solutions formed by these oxides?</p>
	A Al_2O_3 , P_4O_{10} , Na_2O
	B Al_2O_3 , Na_2O , P_4O_{10}
	C Na_2O , Al_2O_3 , P_4O_{10}
	D P_4O_{10} , Al_2O_3 , Na_2O

Answer: D

Metal oxides dissolve in water to form a basic solution while non-metal oxides dissolve in water to form an acidic solution.



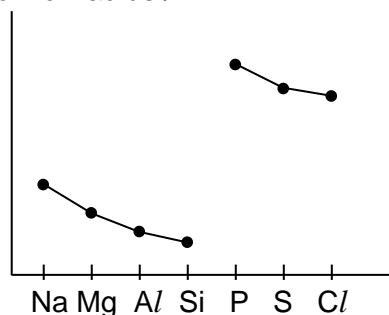
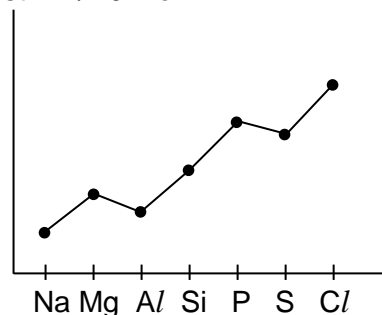
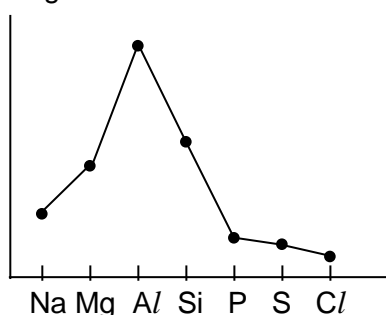
Al_2O_3 has very high lattice energy thus insoluble in water and $\text{pH} \approx 7$



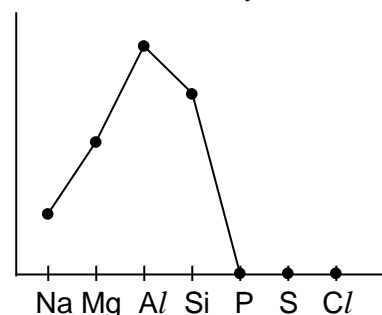
14 Which of the following sketches shows the correct trend in the stated property, for the elements in the third period of the Periodic Table?

A

Atomic Radius / nm

**B**First I.E / kJ mol^{-1} **C**Melting Point / $^{\circ}\text{C}$ **D**

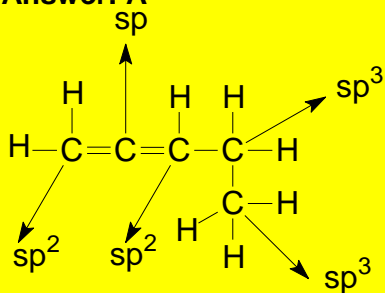
Electrical Conductivity

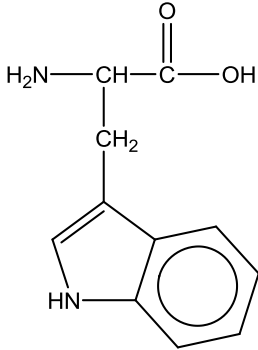
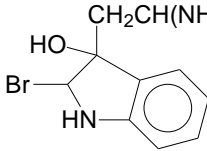
**Answer: B**

A is incorrect. Trend described should be ionic radius.

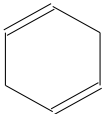
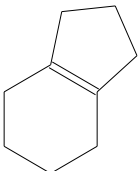
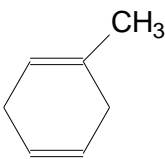
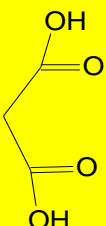
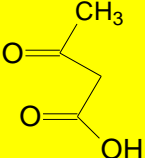
C is incorrect. The mp of S_8 should be higher than P_4 and Si has the highest mp.

D is incorrect as Si is a semi-conductor and does not conduct electricity better than Na and Mg, which are metals.

15	<p>Covalent bonds are formed by orbital overlap. The shape of unsaturated hydrocarbon molecules can be explained in terms of hybridisation of orbitals.</p> <p>Which of the following bond is not present in $\text{CH}_2=\text{C}=\text{CHCH}_2\text{CH}_3$?</p>
A	a π bond formed by $\text{sp} - \text{sp}^2$ overlap
B	a σ bond formed by $\text{sp}^3 - \text{sp}^2$ overlap
C	a σ bond formed by $\text{s} - \text{sp}^3$ overlap
D	a σ bond formed by $\text{sp}^3 - \text{sp}^3$ overlap
<p>Answer: A</p>  <p>A π bond is formed via sideways overlap of unhybridised p orbitals (not hybrid orbitals).</p> <p>In option C: the overlap refers to that between 1s orbital of H and hybrid orbital of C.</p>	

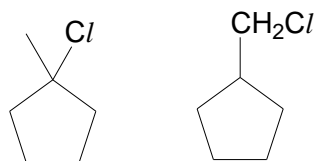
16	<p>Tryptophan is an amino acid and is essential to the human diet. It also serves as a biological precursor to some chemicals associated with the nervous system of the human body.</p> <div style="text-align: center;">  <p>Tryptophan</p> </div> <p>What of the following statements is not true about tryptophan? (Ignore the chemistry of RNH₂ and R₂NH groups)</p>
A	It contains amine, alkene and acid functional groups.
B	<p>It reacts with aqueous bromine to form</p> <div style="text-align: center;">  </div> <p>as the major product.</p>
C	1 mol of tryptophan reacts with sodium metal to give 0.5 mol of hydrogen gas.
D	It exhibits cis-trans isomerism.
<p>Answer: D</p> <p>Cis-trans isomerism is not observed for C=C on cyclic rings.</p>	

17	Which of the following is not a product in the reaction of methane with excess chlorine in the presence of ultraviolet light?
A	H ₂
B	HCl
C	CH ₃ Cl
D	CH ₂ Cl ₂
<p>Answer: A</p> <p>H₂ is not formed in free radical substitution. HCl is the by-product, CH₃Cl is formed when one H is substituted and CH₂Cl₂ is formed when two Hs are substituted.</p>	

18	Which of the following compound forms two organic products when it is heated with acidified potassium manganate(VII) solution?	
	A	$\text{CH}_2=\text{CHCH}_2\text{CH}=\text{CH}_2$
	B	
	C	
	D	
	<p>Answer: D</p> <p>Vigorous oxidation will take place.</p> <p>Compound A only form one organic compound and CO_2 gas since there are terminal double bonds.</p> <p>Compound B only form one organic compound as it is symmetrical.</p> <p>Compound C only form one organic compound as the ring will not be broken.</p> <p>Compound D will form:</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center;">  </div> <div style="margin: 0 10px;">and</div> <div style="text-align: center;">  </div> </div>	

19	Which of the following is not a possible product when 1-iodopropanone reacts with hydrogen cyanide and sodium hydroxide?	
	A	$\begin{array}{c} \text{CN} \\ \\ \text{CH}_3 - \text{C} - \text{CH}_2\text{OH} \\ \\ \text{OH} \end{array}$
	B	$\begin{array}{c} \text{CN} \\ \\ \text{CH}_3 - \text{C} - \text{CH}_2\text{I} \\ \\ \text{OH} \end{array}$
	C	$\begin{array}{c} \text{COO}^- \\ \\ \text{CH}_3 - \text{C} - \text{CH}_2\text{OH} \\ \\ \text{OH} \end{array}$
	D	$\begin{array}{c} \text{COOH} \\ \\ \text{CH}_3 - \text{C} - \text{CH}_2\text{I} \\ \\ \text{OH} \end{array}$
<p>Answer: D</p> <p>Ketones undergo nucleophilic addition with HCN to form cyanohydrins which could then undergo basic hydrolysis with NaOH (aq) to form a salt. D is the wrong structure as carboxylic acid is formed instead of a salt.</p> <p>Halogenoalkanes undergo nucleophilic substitution with NaOH (aq) to form alcohols.</p>		

- 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 RCI : primary RCI formed?

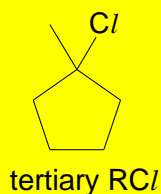
A 1 : 15

B 1 : 3

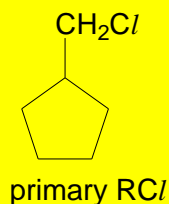
C 3 : 5

D 5 : 3

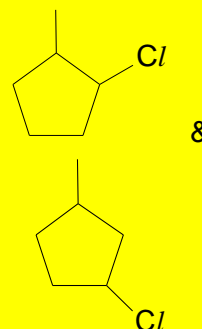
Answer: D



1 H each with reactivity
of 5 = 5



3 H each with
reactivity of 1 = 3



Other 2 products are
secondary RCI

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

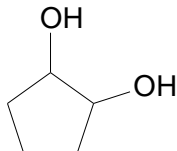
An organic liquid **Q** with molecular formula $\text{C}_5\text{H}_{10}\text{O}_2$, shows a broad absorption at $3100\text{--}3500\text{cm}^{-1}$ in the infra-red spectrum. When **Q** reacts with acidified sodium dichromate(VI) solution, a liquid can be distilled from the reaction mixture. This liquid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

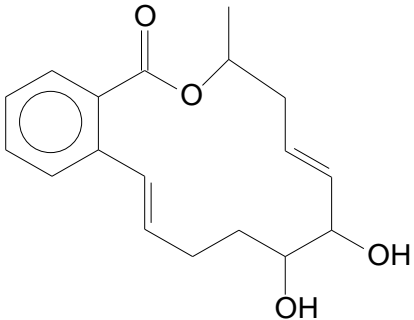
Which of the following is the likely identity of compound **Q**?

A $\text{CH}_3(\text{CH}_2)_3\text{CO}_2\text{H}$

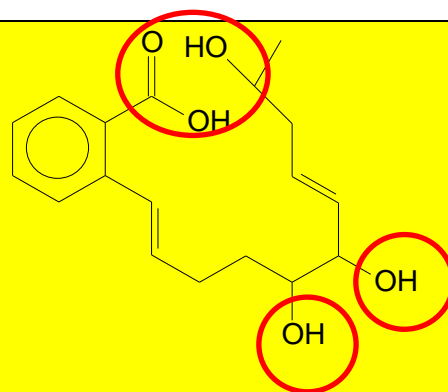
B $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{COCH}_3$

C $\text{HOCH}_2\text{CH}_2\text{COCH}_2\text{CH}_3$

	D								
		<p>Answer: C</p> <table><tr><th>Observation</th><th>Deduction</th></tr><tr><td>Q has with molecular formula $C_5H_{10}O_2$</td><td rowspan="2">From <i>Data Booklet</i>, the functional group present in Q is <u>alcohol</u> (Q cannot be phenol or amine because it has only 5 C and does not contain N atom).</td></tr><tr><td>Q shows absorption of $3100-3500\text{ cm}^{-1}$ in the infra-red spectrum</td></tr><tr><td>Q reacts with acidified sodium dichromate (VI) solution via oxidation to give a liquid which gives a positive test on warming with Fehlings' solution.</td><td>Liquid is an <u>aldehyde</u> Q contains <u>1° alcohol</u>.</td></tr></table>	Observation	Deduction	Q has with molecular formula $C_5H_{10}O_2$	From <i>Data Booklet</i> , the functional group present in Q is <u>alcohol</u> (Q cannot be phenol or amine because it has only 5 C and does not contain N atom).	Q shows absorption of $3100-3500\text{ cm}^{-1}$ in the infra-red spectrum	Q reacts with acidified sodium dichromate (VI) solution via oxidation to give a liquid which gives a positive test on warming with Fehlings' solution.	Liquid is an <u>aldehyde</u> Q contains <u>1° alcohol</u> .
Observation	Deduction								
Q has with molecular formula $C_5H_{10}O_2$	From <i>Data Booklet</i> , the functional group present in Q is <u>alcohol</u> (Q cannot be phenol or amine because it has only 5 C and does not contain N atom).								
Q shows absorption of $3100-3500\text{ cm}^{-1}$ in the infra-red spectrum									
Q reacts with acidified sodium dichromate (VI) solution via oxidation to give a liquid which gives a positive test on warming with Fehlings' solution.	Liquid is an <u>aldehyde</u> Q contains <u>1° alcohol</u> .								

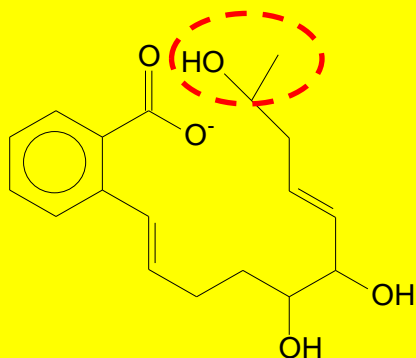
22	<p>Research has shown that Aigialomycin D, a fungal metabolite, is capable of inhibiting crucial enzymes related to cancers.</p> <div style="text-align: center;">  <p>Aigialomycin D</p> </div> <p>Which of the following observation is incorrect?</p>
	<p>A It reacts with hot, acidified $K_2Cr_2O_7$ to give a diketone.</p>
	<p>B It reacts with hot, alkaline aqueous iodine to give a yellow solid.</p>
	<p>C It reacts with Br_2 (aq) to incorporate up to 4 atoms of bromine in each molecule.</p>
	<p>D It reacts with cold, dilute alkaline $KMnO_4$ to give a product containing 8 oxygen atoms.</p>
	<p>Answer: A</p> <p>Upon adding hot acidified $K_2Cr_2O_7$,</p>

ester will undergo acidic hydrolysis to form an acid and 2° alcohol

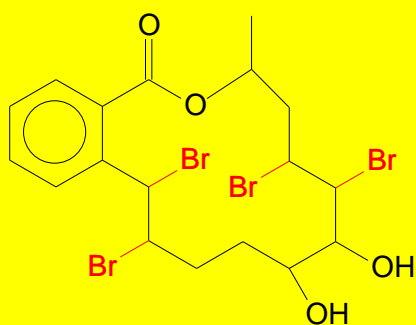


which will then be oxidised to a triketone.

- B** Ester will undergo basic hydrolysis to give a product with CH₃CH(OH)– structure which gives a positive iodoform test.

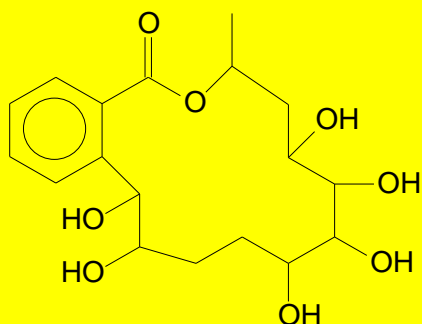


- C** Electrophilic addition of alkenes occurs.

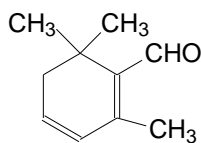


Mild oxidation of alkenes occurs.

- D**



- 23** Safranal is a component of the yellow dyestuff saffron.

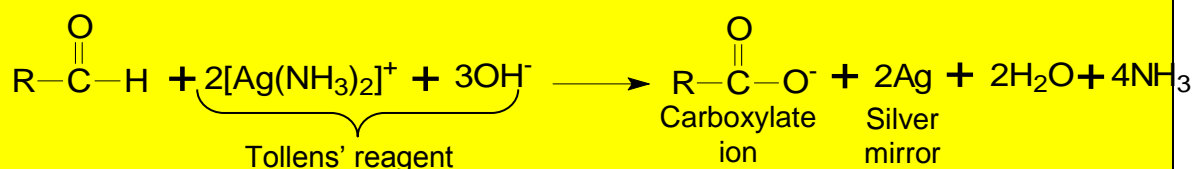


Safranal

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

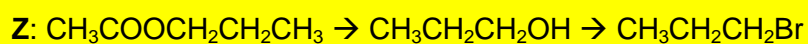
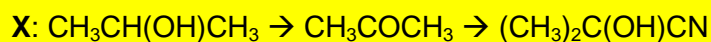
Answer: **B**



- 24** Which pair of reactions *could* have the same common intermediate?

- W** $\text{CH}_3\text{CH}_2\text{CH}_3 \rightarrow \text{intermediate} \rightarrow (\text{CH}_3)_2\text{CHCN}$
X $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3 \rightarrow \text{intermediate} \rightarrow (\text{CH}_3)_2\text{C}(\text{OH})\text{CN}$
Y $\text{CH}_3\text{CH}=\text{CH}_2 \rightarrow \text{intermediate} \rightarrow \text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
Z $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3 \rightarrow \text{intermediate} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
- A** **W** and **X**
B **W** and **Y**
C **X** and **Z**
D **Y** and **Z**

Answer: **B**



25	<p>γ-Valerolactone is a naturally occurring organic compound found in fruits and could be a possible bio-fuel alternative to ethanol.</p> <div data-bbox="738 309 940 409" data-label="Chemical-Block"> </div> <p>γ-valerolactone</p> <p>Which statement about this compound is not correct?</p>	
	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.
	<p>Answer: C</p> <p>γ-valerolactone is an ester, not a carbonyl compound, so it does not react with 2,4-DNPH.</p>	

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).

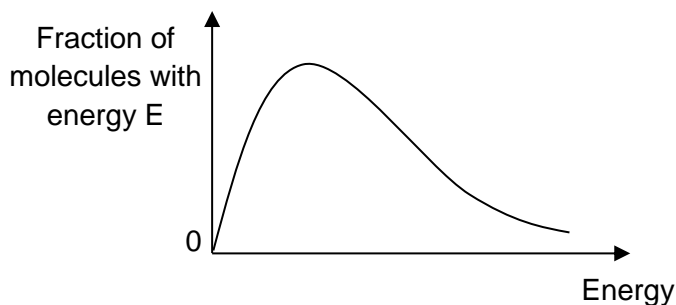
The responses **A** to **D** should be selected on the basis of

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 to be used as correct response.

26	Two conversions are outlined below. $\text{NH}_4^+ \longrightarrow \text{NH}_3$ $\text{C}_2\text{H}_4 \longrightarrow \text{C}_2\text{H}_6$ What similar features 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
<p>Answer: D (1 only)</p> <p>Statement 1 is correct. Bond angle of NH_4^+ is 109.5° and bond angle of NH_3 is 107° Bond angle of C_2H_4 is 120° and bond angle of C_2H_6 is 109.5°.</p> <p>Statement 2 is incorrect. Oxidation state of N in both NH_4^+ and NH_3 is -3. Oxidation state of C in C_2H_4 is -2 where else in C_2H_6 is -3.</p> <p>Statement 3 is incorrect. There is 1 lone pair in NH_3 but 0 lone pair in C_2H_6.</p>	

- 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. |

Answer: B (1 and 2 only)

1 is not true. At low energies, the proportion of molecules decreases.

2 is not true. The maximum of the curve is displaced **downwards** towards the right.

3 is true. With the rightward displacement of the curve, the proportion of molecules with energies above a given value increases.

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

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

Answer: C (2 and 3 only)

For the titration between ethylamine and hydrochloric acid, it is a strong acid/weak base titration. Hence, at equivalence point, pH increases sharply from ≈ 3 to 7.

Only for Congo red and Azolitmin, their pH transition range lies within the region of rapid pH change over the equivalence point.

29	Bromine in tetrachloromethane is added separately to hexane, cyclohexene, benzene and methylbenzene. Which of the following pairs would give the same observations?			
	1	hexane	benzene	
	2	hexane	cyclohexene	
	3	cyclohexene	methylbenzene	
Answer: D (1 only) Br_2 in CCl_4 has no reactions with hexane, benzene and methylbenzene. (hexane needs uv light, benzene and methylbenzene need a catalyst) Br_2 in CCl_4 reacts with alkenes via electrophilic addition.				

30	Methyl ethanoate undergoes acid hydrolysis in the presence of water labelled with the ^{18}O isotope. Which of the following products are formed?	
	1	$\text{CH}_3\text{CO}^{18}\text{OH}$
	2	$\text{CH}_3^{18}\text{OH}$
	3	$\text{CH}_3\text{CH}_2^{18}\text{OH}$
Answer: D (1 only) $\text{CH}_3-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3 + \text{H}_2^{18}\text{O} \longrightarrow \text{CH}_3\text{OH} + \text{H}^{18}\text{OOCCH}_3$		

END OF PAPER