INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION 2
in preparation for General Certificate of Education Advanced Level
Higher 2

CANDIDATE NAME			
CLASS		INDEX NUMBER	

CHEMISTRY 9647/01

Paper 1 Multiple Choice **14 September 2011**

1 hour

Additional Materials: Data Booklet
Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name and class on all the work you hand in.
Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** 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.

Section A

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

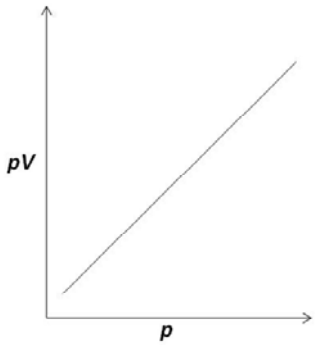
1 0.5 g of zinc powder was found to reduce an acidified solution of 25.50 cm^3 of 0.200 mol dm^{-3} $\mathbf{A}O_2^+$. What is the final oxidation number of metal **A**?

A 0 **C** +2

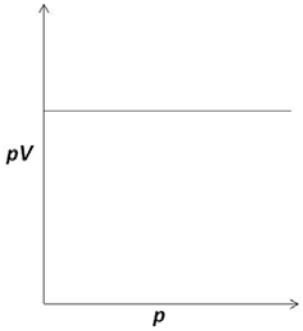
B +1 **D** +3

2 Which graph is obtained when pV is plotted against p for a fixed amount of an ideal gas at constant temperature?

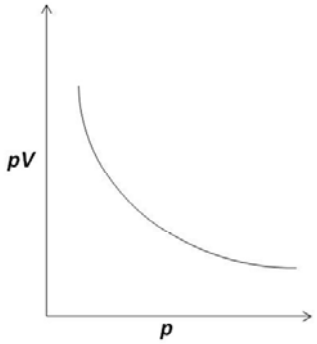
A



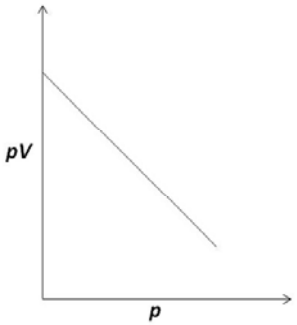
C



B



D



3 Gaseous particle **B** has a proton number n and a charge of +1.
Gaseous particle **C** has a proton number of (n+1) and is isoelectronic with **B**.
B and **C** have the same number of neutrons.

Which of the following statements **incorrectly** describes **B** and **C**?

A The charge of **B** is half that of **C**.

B **B** has a larger ionic radius than **C**.

C **B** requires less energy than **C** when a further electron is removed from each particle.

D **B** has a higher charge density than **C**.

4 *The use of the Data Booklet is relevant to this question.*

D and **E** are in Group V and Group VI respectively. Which of the following comparisons between the first and second ionisation energies of **D** and **E** is correct?

	1st I.E.	2nd I.E.
A	**D < E**	**D > E**
B	**D < E**	**D < E**
C	**D > E**	**D > E**
D	**D > E**	**D < E**

5 Three substances **F**, **G** and **H** have physical properties as shown.

Substance	Melting point/ °C	Boiling point/ °C	Electrical conductivity	
			of solid	of liquid
F	801	1413	Poor	Good
G	2852	3600	Poor	Good
H	3550	4827	Good	Unknown

What could be the identities of **F**, **G** and **H**?

	F	**G**	**H**
A	$AlCl_3$	NaCl	C (diamond)
B	$AlCl_3$	MgO	C (graphite)
C	NaCl	MgO	C (graphite)
D	NaCl	MgO	C (diamond)

6 Which one of the following pairs contains substances with a similar shape?

A CO_2 and I_3^-

B NH_3 and NO_3^-

C $BeCl_2$ and $SnCl_2$

D BCl_3 and PCl_3

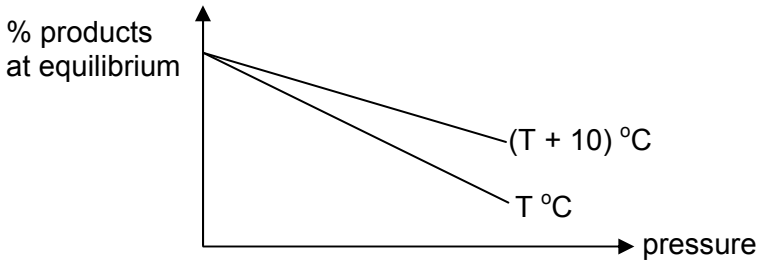
7 One of the key production stages in the Contact Process is the production of sulfur trioxide by the reaction below:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The rate constants of the forward and backward reactions are given as k_1 and k_{-1} respectively. What happens to the equilibrium constant K_c, k_1 and k_{-1} if the volume of the reaction vessel is decreased at constant temperature at equilibrium?

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

8 The graphs below show how the percentage of gaseous products present at equilibrium vary with temperature and pressure.



Which one of the following reactions could the graph represent?

A $H_2(g) + I_2(g) \rightleftharpoons 2HI\ (g)$ $\quad \Delta H = +53$ kJ mol^{-1}

B $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\quad \Delta H = -92$ kJ mol^{-1}

C $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ $\quad \Delta H = +57$ kJ mol^{-1}

D $C(s) + O_2(g) \rightleftharpoons CO_2(g)$ $\quad \Delta H = -394$ kJ mol^{-1}

9 *The use of the Data Booklet is relevant to this question.*

Given the following enthalpy changes,

$Mg(s) \longrightarrow Mg^{2+}(g) + 2e$ $\quad \Delta H = +2353$ kJ mol^{-1}

$\frac{1}{2} O_2(g) + 2e \longrightarrow O^{2-}(g)$ $\quad \Delta H = +897$ kJ mol^{-1}

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

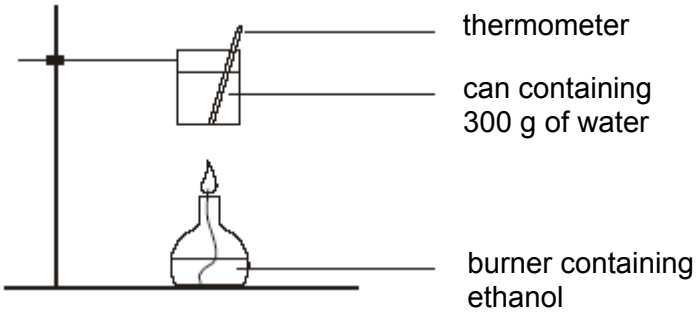
A The sum of the first and second ionisation energies of magnesium is +2353 kJ mol^{-1}.

B The sum of the first and second electron affinities of oxygen is +649 kJ mol^{-1}.

C The enthalpy change of atomisation of magnesium is +167 kJ mol^{-1}.

D The enthalpy change of formation of $Mg^{2+}(g)$ is +2353 kJ mol^{-1}.

10 An experiment was conducted to determine the efficiency of the heating of a can of water using a spirit burner.



The following data were recorded:

Mass of ethanol burnt	= m g
Change in temperature of water	= ΔT °C

You are also given that:

Relative molecular mass of ethanol	= 46.0
Enthalpy change of combustion of ethanol	= –1371 kJ mol^{-1}
Specific heat capacity of water	= c J g^{-1} K^{-1}

Which expression below gives the efficiency of this heating process?

A $\dfrac{300 \times c \times \Delta T \times 46.0}{m \times 1371 \times 1000} \times 100\%$

B $\dfrac{m \times c \times \Delta T \times 46.0}{300 \times 1371 \times 1000} \times 100\%$

C $\dfrac{300 \times c \times \Delta T \times 46.0}{m \times 1371} \times 100\%$

D $\dfrac{m \times 1371 \times 1000}{300 \times c \times \Delta T \times 46.0} \times 100\%$

11 The solubility products of silver chloride and silver carbonate at 25 °C are 2 x 10^{-10} mol^2 dm^{-6} and 8 x 10^{-12} mol^3 dm^{-9} respectively.

Which of the following statements is **not** true?

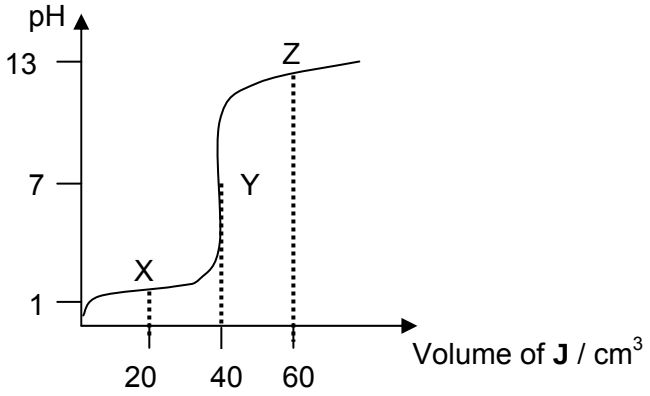
A When silver nitrate is added into a 1 dm^3 solution containing 0.01 mol of chloride and 0.01 mol of carbonate ions, silver chloride precipitates out first.

B Silver chloride has a lower molar solubility than silver carbonate.

C Addition of hydrochloric acid increases the solubility of silver carbonate.

D Addition of sodium chloride to a solution containing silver chloride decreases the solubility product of silver chloride.

12 The following graph shows the pH changes when a 0.10 mol dm^{-3} solution of **J** is added to 20.0 cm^3 of 0.10 mol dm^{-3} of sulfuric acid.



Which of the following statements regarding the titration is correct?

A **J** is a weak monoprotic base.

B There are no buffer regions in this graph.

C Phenolphthalein is a suitable indicator for this titration, but not methyl orange.

D At point Y, the salt at end point is hydrolysed to give an acidic solution.

13 Consider the sequence of oxides Na_2O, SiO_2, P_4O_{10}.

Which factor decreases from Na_2O to SiO_2 and also from SiO_2 to P_4O_{10}?

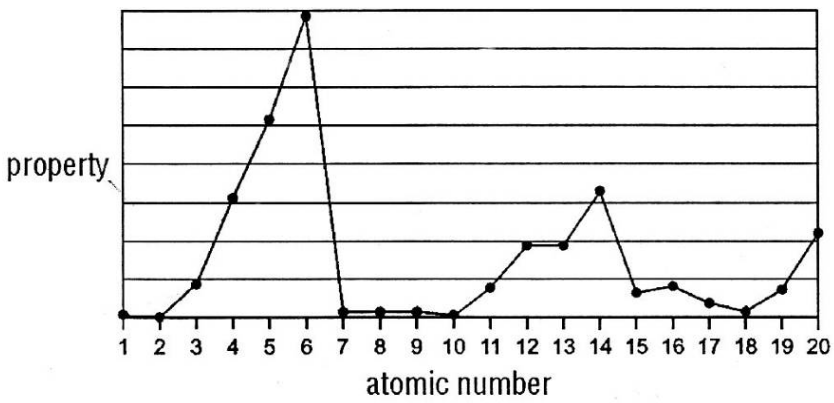
A covalent character

B electrical conductivity in the solid state

C pH when mixed with water

D solubility in aqueous alkali

14 The following shows the variation of a property of the first 20 elements in the Periodic Table with the atomic number of the element.



What is the property?

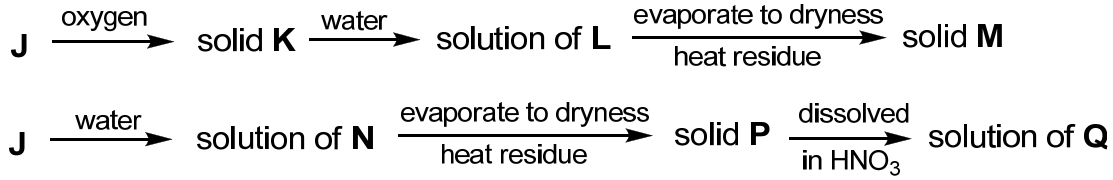
A atomic radius

B first ionisation energy

C ionic radius

D melting point

15 **J** is a Group II metal which can undergo two reaction routes.



Which set contains three different compounds?

A **K M P**

B **K L Q**

C **L N Q**

D **M N P**

16 How would the magnitude of the following vary down Group II?

(i) the standard electrode potential of $M^{2+}(aq)/ M(s)$, E^{θ}

(ii) the lattice energy of the oxide, ΔH_{latt}

(iii) the standard enthalpy change of hydration of $M^{2+}(g)$, ΔH^{θ}_{hyd}

	$E^{\theta}_{M^{2+}/M}$	ΔH_{latt} *of MO(s)*	ΔH^{θ}_{hyd} *of* $M^{2+}(g)$
A	increases	decreases	decreases
B	decreases	decreases	increases
C	increases	increases	decreases
D	increases	increases	increases

17 Which products are obtained when chlorine is bubbled into hot concentrated aqueous sodium hydroxide?

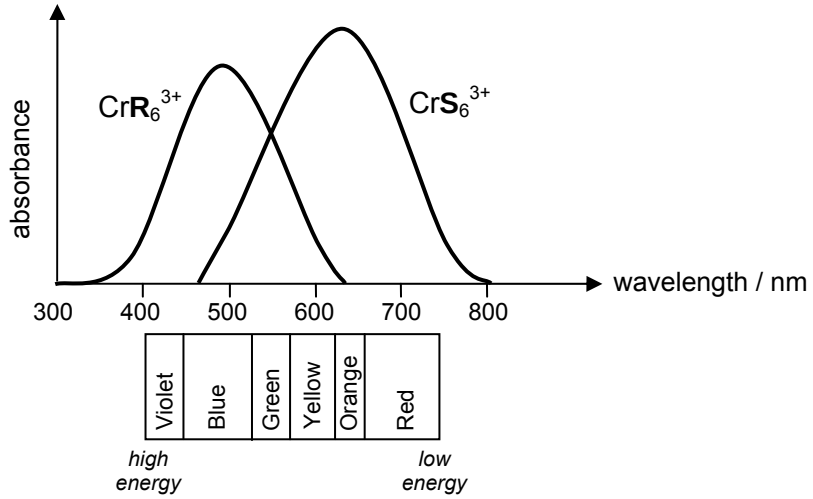
A NaC*l* and NaC*l*O

B NaC*l* and NaC*l*O_3

C NaC*l*O only

D NaC*l*O_3 only

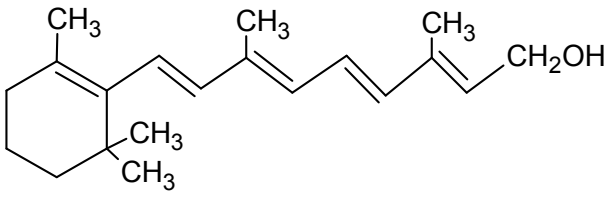
18 The diagram below shows the visible spectra of two chromium(III) complexes, $Cr\mathbf{R}_6^{3+}$ and $Cr\mathbf{S}_6^{3+}$. The various colours corresponding to the approximate wavelengths in the visible light region are shown below the axis.



What is the colour of each complex and which ligand causes a larger d-orbital splitting?

	colour of $Cr\mathbf{R}_6^{3+}$	colour of $Cr\mathbf{S}_6^{3+}$	ligand which causes a larger d-orbital splitting
A	blue	yellow orange	**R**
B	blue	yellow orange	**S**
C	red	violet	**R**
D	red	violet	**S**

19 The structure of Vitamin A is shown below.



Vitamin A

After it reacts completely with hydrogen in the presence of a nickel catalyst, what is the total number of possible stereoisomers for the product?

A 2^2 **C** 2^4

B 2^3 **D** 2^5

20 Which of the following is a **propagation** step in the reaction between propane and bromine when they are irradiated with ultraviolet light?

A $CH_3CH_2CH_2Br + Br\bullet \longrightarrow CH_3CH_2CH_2\bullet + Br_2$

B $CH_3CH_2CH_2\bullet + Br\bullet \longrightarrow CH_3CH_2CH_2Br$

C $CH_3CH_2CHBr\bullet + Br_2 \longrightarrow CH_3CH_2CHBr_2 + Br\bullet$

D $CH_3CH_2CH_2\bullet + Br_2 \longrightarrow CH_3CH_2CHBr\bullet + HBr$

21 Fly paper is used as a non-toxic method of trapping houseflies. To increase its effectiveness and attractiveness, *Muscalure*, which is a fly sex pheromone, is added to the paper during its manufacture. *Muscalure* has the following structure:

$$CH_3(CH_2)_7CH{=}CH(CH_2)_{12}CH_3$$

Which of the following statements about *Muscalure* is **incorrect**?

A In the presence of excess bromine and *uv* light, it undergoes free radical substitution.

B It exists as a pair of geometrical isomers.

C It gives a diol with cold, dilute acidified potassium dichromate(VI).

D It can be extracted from the fly paper by soaking the paper in benzene.

22 Organic compound **T** underwent the following successive reactions:

I reaction with hydrogen chloride
II boiling with aqueous sodium hydroxide
III reaction with hot concentrated phosphoric acid

The final organic product was ethene.

Which of the following could most likely be compound **T**?

A ethene

B ethanol

C chloroethane

D ethanoic acid

23 The table shows the results of simple tests on a compound **U**.

Reagents	Observations
2,4-dinitrophenylhydrazine	Orange ppt
Fehling's reagent	Brick red ppt
Alkaline aqueous iodine	Yellow ppt

From the results of the tests, what could **U** be?

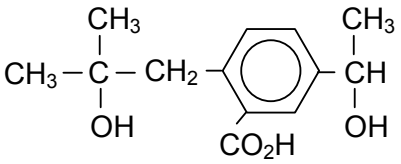
A CH_3CHO

B CH_3CH_2CHO

C $CH_3CH(OH)CH_3$

D CH_3COCH_3

24 The compound Ibuprofen is a powerful painkiller.



Ibuprofen

Which of the following reacts exactly with one mole of Ibuprofen?

A 2 mol of CH_3COCl

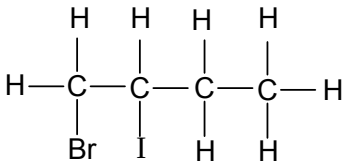
B 3 mol of HCl

C 2 mol of PCl_5

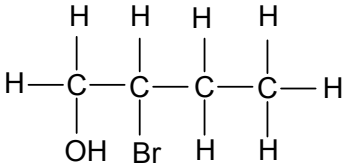
D 3 mol of NaOH

25 Which of the following is **not** the product formed when butene reacts with IBr(aq)?

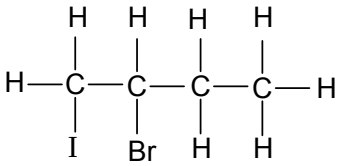
A



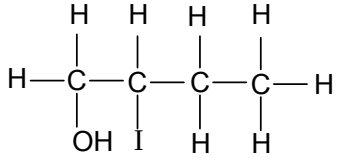
B



C



D



26 A student attempted to perform a reaction on 3 different organic compounds using different reducing agents. He recorded his results as shown in the table below:

Test	Compounds	H_2/Ni	$LiAlH_4$	$NaBH_4$
I	$CH_3CH_2COCH_3$	√	√	√
II	$CH_3CH=CHCH_3$	√	**X**	**X**
III	CH_3CH_2COOH	**X**	√	**X**

Which of the test results are correct?

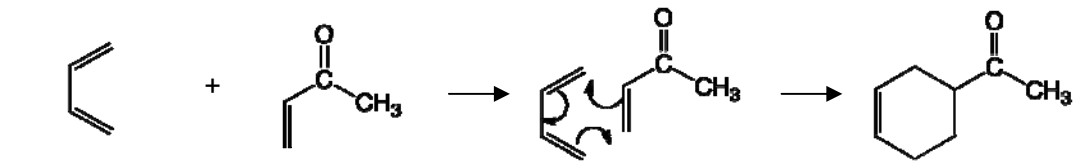
A I, II & III

B I & III

C II & III

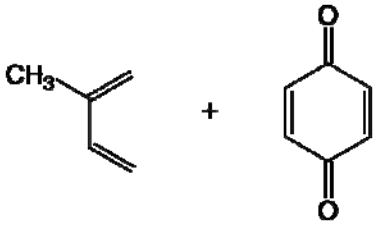
D I & II

27 The Diels-Alder reaction is an organic reaction between a conjugated diene and a substituted alkene to form a substituted cyclohexene system. One such reaction between buta-1,3-diene and but-3-en-2-one is shown below.

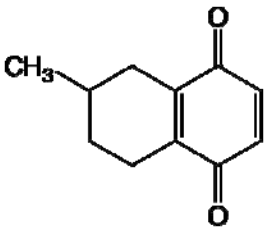


buta-1,3-di-ene but-3-en-2-one substituted cyclohexene

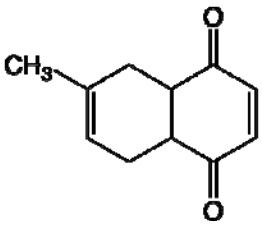
What would be the product formed when the following diene and substituted alkene reacts in a 1:1 ratio?



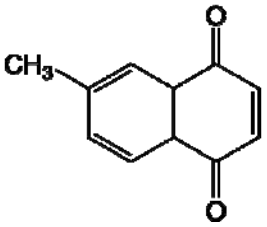
A



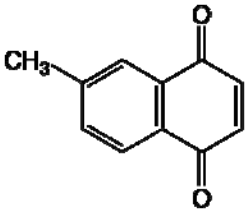
B



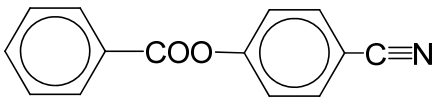
C



D



28 Which one of the following is formed when the compound **V** is refluxed with an excess of aqueous alkali?



compound **V**

A $C_6H_5COO^-$ and $^-OC_6H_4COO^-$

B $C_6H_5COO^-$ and $HO–C_6H_4COOH$

C $C_6H_5O^-$ and $^-OC_6H_4COO^-$

D C_6H_5OH and $HOOC–C_6H_4C{\equiv}N$

29 Which of the following proteins will **not** retain its primary structure?

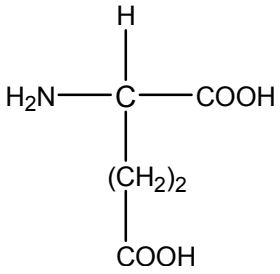
A Beating the egg white using a glass rod.

B Boiling insulin with dilute hydrochloric acid.

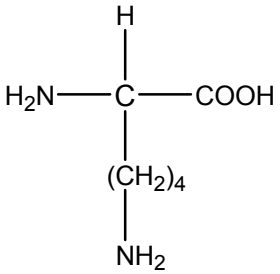
C Adding drops of tetrachloromethane to collagen.

D Mixing Ca^{2+} ions to casein.

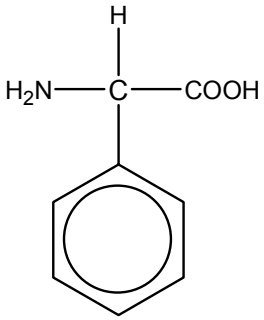
30 The structures of some amino acids are shown below:



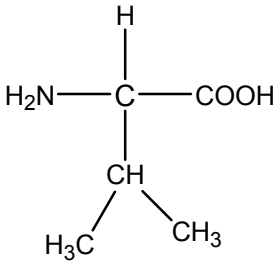
glutamic acid



lysine



phenylalanine



valine

Which of the following pairs of amino acids are likely to be found on the exterior of a globular protein?

A glutamic acid and lysine

B valine and phenylalanine

C glutamic acid and valine

D lysine and phenylalanine

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** are correct	**2** and **3** are correct	**1** only is correct.

31 Which statement(s) about 28.0 g sample of $^{14}N_2$ is/are correct?

1 The number of atoms is the same as the number of atoms in 24.0 g of ^{12}C.

2 The number of atoms is the same as the number of atoms in 4.0 g of ^{4}He.

3 The number of molecules is the same as the number of atoms in 32.0 g of $^{16}O_2$.

32 The wave energy produced in microwave oven is absorbed by certain polar molecules. Which of the following molecule(s) would absorb microwave energy?

1 CH_3CH_2OH

2 PH_3

3 SF_6

33 Which of the following statement(s) is/are always **true**?

1 A catalyst increases the rates of both forward and backward reactions for a reversible reaction.

2 Halving the pressure of a gaseous reaction increases the rate of reaction.

3 The rate of forward reaction increases as the reaction proceeds.

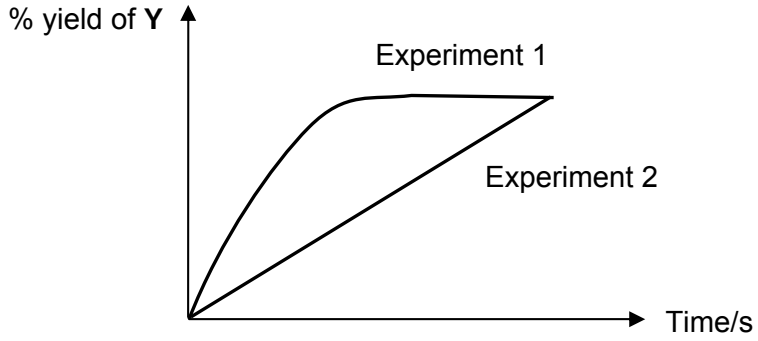
The responses **A** to **D** should be selected on the basis of

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

34 The following equation represents a catalysed reaction.

$$\mathbf{W}(g) + \mathbf{X}(g) \rightleftharpoons \mathbf{Y}(g) + \mathbf{Z}(g)$$

Two experiments were carried out in which the % yield of **Y** was measured against time. The results are shown in the diagram below.



Which change(s) in the conditions from experiment 1 to experiment 2 might explain the results?

1 A different catalyst was used.

2 Less of **W** was used.

3 Product **Z** was continuously removed from the reaction vessel.

35 When a solution of concentrated sodium ethanoate is electrolysed, the equation for the reaction is

$$2\ CH_3CO_2Na + 2\ H_2O \longrightarrow CH_3CH_3 + 2\ CO_2 + 2\ NaOH + H_2$$

Which statement(s) regarding the electrolysis is/are **correct**?

1 Hydrogen is liberated at the cathode.

2 Carbon dioxide is liberated at the anode.

3 Ethane is liberated at the cathode.

36 Which of the following factor(s) explain why magnesium sulfate is more soluble than barium sulfate?

1 The ionic radius of Ba^{2+} is larger than that of Mg^{2+}.

2 The enthalpy change of hydration of Mg^{2+} is more exothermic than that of Ba^{2+}.

3 The ionic radius of the sulfate ion is smaller than that of the cations, Mg^{2+} and Ba^{2+}.

37 The results of experiments in which the halogens $\mathbf{A}_2$, $\mathbf{B}_2$ and $\mathbf{C}_2$ were added to separate aqueous solutions of $\mathbf{A}^-$, $\mathbf{B}^-$ and $\mathbf{C}^-$ ions are shown in the table below:

	$\mathbf{A}^-$	$\mathbf{B}^-$	$\mathbf{C}^-$
$\mathbf{A}_2$	No reaction	No reaction	$\mathbf{A}^-$ formed
$\mathbf{B}_2$	$\mathbf{B}^-$ formed	No reaction	$\mathbf{B}^-$ formed
$\mathbf{C}_2$	No reaction	No reaction	No reaction

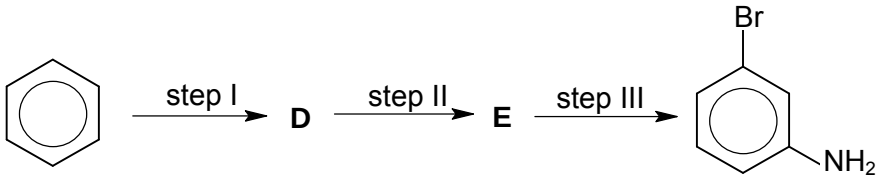
Which of the following statement(s) correctly account for the observations?

1 The order of oxidising power in increasing order is $\mathbf{C}_2 < \mathbf{A}_2 < \mathbf{B}_2$.

2 $\mathbf{B}^-$ is a weaker reducing agent than $\mathbf{C}^-$.

3 $\mathbf{A}^-$ is the weakest reducing agent.

38 Benzene can be converted into 3-bromophenylamine in three steps.



Which of the following conversion route(s) **will not** give 3-bromophenylamine either as a major or minor product?

	step I	step II	step III
1	bromination	reduction	nitration
2	nitration	reduction	bromination
3	nitration	bromination	reduction

39 Which of the following has at least one gaseous product at room temperature and pressure?

1 Reduction of hexanal by H_2 gas and nickel catalyst

2 Hydrolysis of ethanamide, CH_3CONH_2, by NaOH (aq)

3 Side chain oxidation of ethylbenzene

40 Which of the following is/are true about alanine (2-aminopropanoic acid) extracted from silkworm silk?

1 Alanine is able to rotate plane polarised light.

2 Alanine has a higher solubility in water than in ether.

3 Alanine can react with ethanoic acid to give an amide.

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