TAYLOR'S COLLEGE

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Class	Student Number	Name

CAMBRIDGE A LEVEL PROGRAMME
AS TRIAL EXAMINATION MARCH/APRIL 2011
(June 2010 Intake)

Monday	**28 March 2011**	**9.45 am – 11.00 am**

CHEMISTRY

9701/22

PAPER 2 Structured Questions AS Core

1 hour 15 minutes

Candidates answer on the Question Paper
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, class and student number in the spaces at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples , paper clips , highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets[ ] at the end of each question or part question.
You may lose marks if you do not show your working or if you do not use appropriate units
A Data Booklet is provided

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

This document consists of **11** printed pages

1   (a) Complete the following table.

Particle	Relative mass	Relative charge
Proton		
Electron		

[2]

(b) An atom has twice as many protons and twice as many neutrons as an atom of ^{19}F. Deduce the symbol, including the mass number, of this atom.

....

[1]

(c) The Al^{3+} ion and the Na^+ ion are isoelectronic.

(i) Write the electron configuration of these ions.

....

(ii) Explain why more energy is needed to remove an electron from the Al^{3+} ion than from the Na^+ ion.

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....

[3]

(d) The relative abundance of each isotope in a sample of platinum is shown in the table

m/e	194	195	196	198
Relative abundance (%)	32.8	30.6	25.4	11.2

Use the data in the table to calculate the relative atomic mass of this sample of platinum, giving your answer to **one** decimal place.

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....

[2]

[Total: 8]

2 The atomic radii of the elements Li to F and Na to Cl are shown in the table below.

Element	Li	Be	B	C	N	O	F
Atomic radius/nm	0.134	0.125	0.090	0.077	0.075	0.073	0.071
Element	Na	Mg	Al	Si	P	S	Cl
Atomic radius/nm	0.154	0.145	0.130	0.118	0.110	0.102	0.009

(a) Using only the elements in this table, select

(i) an element with both metallic and non- metallic properties,

....

(ii) the element with the largest first ionisation energy,

....

(iii) an element with a giant molecular structure

....

(iv) an element that forms an oxide that is insoluble in water

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[4]

(b) Explain what causes the general decrease in atomic radii across each period?

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[2]

[Total: 6]

3   The equation below represents a reaction in equilibrium.

$$N_2O_4(g) \quad \rightleftharpoons \quad 2NO_2(g)$$
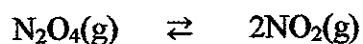
(a)   Explain the term *Dynamic equilibrium.*

....

....

[2]

(b)   State and explain the effect on the yield of 'NO_2' if the pressure on the system is increased.

Effect..

Explanation...

....

....

[2]

(c)   At 30°C and 1.0 atm pressure, 30% of N_2O_4 is dissociated. Calculate the equilibrium constant, K_p, for this reaction.

....

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....

....

[3]

[Total: 7]

4 (a) (i) State the trend in oxidising ability of the halogens from fluorine to iodine.

....

(ii) Write an equation to show the reaction between chlorine and KBr.

....

(iii) What would you observe during this reaction?

....

[3]

(b) Explain, in terms of the intermolecular forces present, why

(i) the boiling point of HF is much higher than those of the other hydrogen halides

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....

(ii) the boiling points increase from HCl to HI

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[4]

(c) Write an equation for the reaction between chlorine and cold, dilute aqueous NaOH.

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[1]

[Total: 8]

5 (a) Define the term standard *Enthalpy change of combustion, $\Delta H_c^{\ominus}$*.

....

....

....

[2]

(b) An experiment was carried out to determine a value for the enthalpy of combustion of liquid methylbenzene.

Burning 2.5 g of methylbenzene caused the temperature of 250 g of water to rise by 60°C. Use this information to calculate a value for the enthalpy of combustion of methylbenzene, C_7H_8.

(The specific heat capacity of water is $4.18JK^{-1}g^{-1}$. Ignore the heat capacity of the container.)

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[3]

[Total: 5]

[Turn over

6   At room temperature, both sodium metal and sodium chloride are crystalline solids which contain ions.

   (a)   Draw diagrams for sodium metal and sodium chloride, showing the arrangement of particles in the crystal lattice of each. Mark the charge for ions in each diagram.

[2]

   (b)   Compare the electrical conductivity of solid sodium metal with that of solid NaCl . Explain your answer.

Comparison..

....

Explanation...

....

....

[2]

   (c)   Sodium chlorate (V), contains 21.6 % by mass of sodium, 33.3% by mass of chlorine and 45.1% by mass of oxygen. Use this data to find the empirical formula of sodium chlorate(V)

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[2]

[Total: 6]

7   Chlorine and methane react together to form chloromethane.

(a) What are the conditions required for this reaction?

....

[1]

(b) Describe, with equations, the mechanism of this reaction. Name each stage of the reaction.

[3]

(c) Name and draw the displayed formulae of the organic products formed, when 2-methyl pent-2-ene reacts with hot, concentrated acidified $KMnO_4$.

....

[2]

[Total: 6]

[Turn over

8   2-Bromo-2- methyl propane reacts with aqueous KOH solution via an S_N1 mechanism.

(a) Draw and explain this mechanism by using curly arrows to show the movement of electrons. Clearly indicate any electrons involved, and any intermediate species formed during the reaction.

(

[3]

(b) (i) Describe the shape of the intermediate species.

....

(ii) Describe how the reaction of ethanolic KOH with 2 bromo-2-methyl propane differ from the above reaction?

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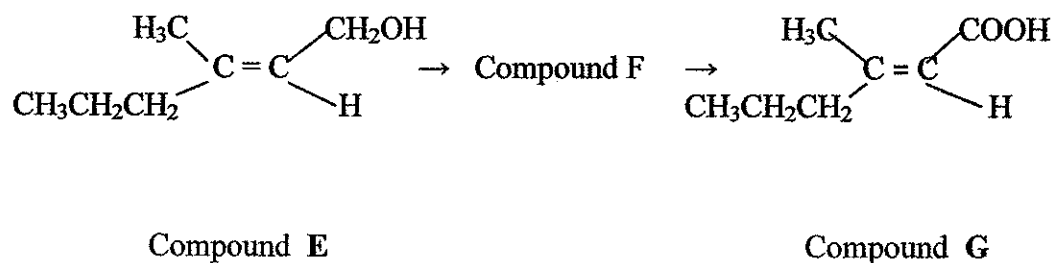
(iii) Draw the displayed formula and give name of the organic product of the reaction in (b)(ii).

[3]

(c)   The formula of a compound **E**, is shown below .Compound **E** can be oxidised to form compounds **F** and **G**.

$$H_3C \diagdown C = C \diagup CH_2OH$$
$$CH_3CH_2CH_2 \diagup \qquad \diagdown H$$

→ Compound F →

$$H_3C \diagdown C = C \diagup COOH$$
$$CH_3CH_2CH_2 \diagup \qquad \diagdown H$$

Compound **E**   Compound **G**

(i)   Compound **E** contains two functional groups. Identify both functional groups and state how you could test for each.

Functional group 1   ....

Test   ....

Observations   ....

Functional group 2   ....

Test   ....

Observations   ....

(ii)   Suggest the structural formula of compound **F**.

(iii)   State the name of a reagent that can be used in the lab to oxidize Compound **E** directly to **G**.

....

[8]

[Total: 14]