Dalziel High School
Chemistry Department
1999 CSYS

CERTIFICATE OF SIXTH YEAR STUDIES 1999

MONDAY, 17 MAY
1.30 PM – 3.10 PM

CHEMISTRY
Paper

Read Carefully

1 Check that the answer sheet provided is for Certificate of Sixth Year Studies Chemistry Paper II.

2 Fill in the details required on the answer sheet.

3 Reference may be made to the Chemistry (Revised) Higher Grade and Certificate of Sixth Year Studies Data Booklet (1992 edition).

4 Rough working, if required, should be done only on this question paper, or on the rough working sheet provided—**not** on the answer sheet.

5 Instructions for the completion of **Part 1** and **Part 2** are given on pages two and nine respectively.

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MCB 0500/302 6/3/5136

1. Which of the following ions has the same total number of electrons as F^-?

   A S^{2-}

   B Na^+

   C Li^+

   D Cl^-

2. The standard enthalpy of formation of sodium chloride is represented by

   A $Na^+(g) + Cl^-(g) \rightarrow Na^+Cl^-(g)$

   B $Na^+(g) + Cl^-(g) \rightarrow Na^+Cl^-(s)$

   C $Na(s) + Cl(g) \rightarrow Na^+Cl^-(s)$

   D $Na(s) + \frac{1}{2}Cl_2(g) \rightarrow Na^+Cl^-(s)$.

3. In which of the following examples does Y represent the mean bond dissociation enthalpy for (O–H) in water?

   A $H_2O(g) \rightarrow O(g) + H_2(g)$ $\quad \Delta H = 2Y$

   B $H_2O(g) \rightarrow O(g) + 2H(g)$ $\quad \Delta H = 2Y$

   C $H_2O(g) \rightarrow O(g) + 2H(g)$ $\quad \Delta H = Y$

   D $H_2O(g) \rightarrow O(g) + H_2(g)$ $\quad \Delta H = Y$

4. Which of the following species can reduce a solution of nickel(II) ions to nickel, assuming standard conditions?

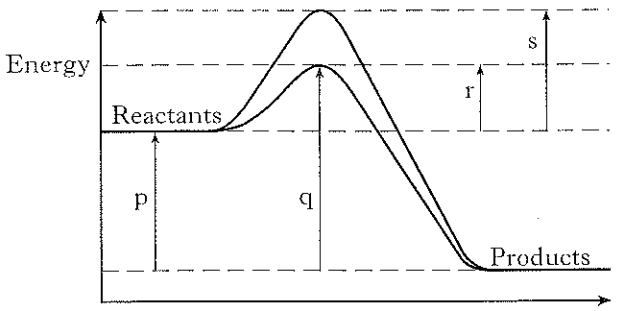
   A Pb(s)

   B $Pb^{2+}(aq)$

   C Zn(s)

   D $Zn^{2+}(aq)$

5. The following diagram illustrates the catalysed and uncatalysed reaction pathways for a reversible reaction.



   The activation energy for the reverse uncatalysed reaction is given by

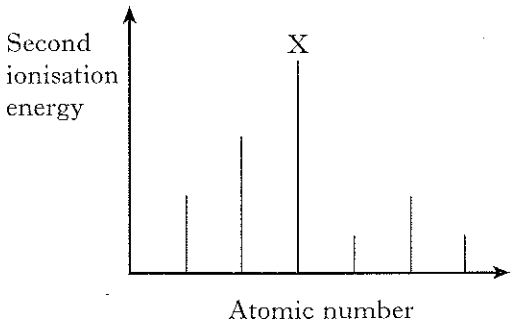
   A s – r

   B p + s

   C q – p

   D p + r.

6. The **second** ionisation energies of six consecutive elements in the Periodic Table are shown below.



   Element X is

   A a halogen

   B a noble gas

   C an alkali metal

   D a group II metal.

[Turn over

Questions 7 and 8 refer to the following.

(i) $I_2(s) \rightarrow I_2(g)$ $\Delta H = +30\,kJ$

(ii) $\frac{1}{2}I_2(g) \rightarrow I(g)$ $\Delta H = +76\,kJ$

(iii) $I(g) \rightarrow I^-(g)$ $\Delta H = -298\,kJ$

(iv) $I^-(g) \rightarrow I^-(aq)$ $\Delta H = -306\,kJ$

7. Which equation represents the enthalpy of sublimation of iodine?

A (i)

B (ii)

C (iii)

D (iv)

8. What is the enthalpy change, in kJ, for the reaction

$$\tfrac{1}{2}I_2(s) \rightarrow I^-(aq)?$$

A +498

B −498

C −513

D −528

9. One mole of oxygen molecules is required for the complete combustion of 0·5 mol of

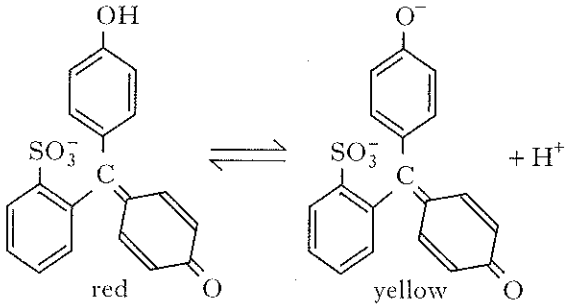
A carbon monoxide

B methane

C hydrogen

D ethyne.

10. Consider the following equilibrium in an aqueous solution.



On addition of an alkali,

A the equilibrium position will move to the left

B the colour will become predominantly red

C there will be further dissociation into yellow ions

D there will be an increase in the $H^+(aq)$ concentration.

11. The radioactive decay series, which ends with $^{204}_{82}Pb$ after 7 alpha and 6 beta emissions, must have commenced with

A $^{232}_{90}Th$

B $^{236}_{92}U$

C $^{238}_{92}U$

D $^{240}_{94}Pu$.

12. Which of the following changes is likely to be endothermic?

A $K(g) \rightarrow K^+(g) + e^-$

B $Ni^{2+}(g) + 6H_2O(\ell) \rightarrow [Ni(H_2O)_6]^{2+}$

C $Ni^{2+}(g) + 2Cl^-(g) \rightarrow NiCl_2(s)$

D $C(g) + 4H(g) \rightarrow CH_4(g)$

13. Primary standards in volumetric analysis should possess certain characteristics. Which of the following is **not** one of these?

A Available in high degree of purity

B Readily soluble

C Stable in solution

D Readily absorbs atmospheric moisture

14. EDTA forms a 1 : 1 complex with $Ni^{2+}(aq)$. What is the concentration, in $mol\,l^{-1}$, of a nickel(II) solution, if $20\,cm^3$ of it reacts with 2×10^{-3} moles of EDTA?

A 0·002

B 0·01

C 0·02

D 0·1

15. Which of these electron arrangements breaks Hund's rule of maximum multiplicity?

A 4s ⇅ 3d 1 1 1 1 ☐

B 4s ⇅ 3d ⇅ 1 1 1 ☐

C 4s ⇅ 3d ⇅ ⇅ 1 1 1

D 4s ⇅ 3d 1 1 1 1 1

16. In which of the following processes are $\Delta H°$ and $\Delta S°$ both positive?

A The explosion of nitroglycerine

B The neutralisation of sulphuric acid by sodium hydroxide

C The polymerisation of ethene

D The evaporation of ethoxyethane

17. The following reaction is thermodynamically feasible at 298 K.

$$Ag^+(aq) + Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$$

The most likely combination of signs for the $\Delta S°$ and $\Delta H°$ values in this reaction are

	$\Delta S°$	$\Delta H°$
A	+	+
B	−	−
C	+	−
D	−	+

18. $P + 2Q \rightarrow R + S \qquad \Delta G° = +10\,kJ$

Which of the following **cannot** be deduced from the above information?

A Feasibility of the reaction

B Order of the reaction

C Position of equilibrium

D Stoichiometry of the reaction

19. For the reaction

$$NO(g) + N_2O_5(g) \rightarrow 3NO_2(g)$$

the following mechanism is suggested.

Step 1 $N_2O_5(g) \rightarrow NO_2(g) + NO_3(g)$ slow

Step 2 $NO(g) + NO_3(g) \rightarrow 2NO_2(g)$ fast

Experimental evidence to support this would be obtained if the rate of the reaction equals

A $k[N_2O_5]$

B $k[NO]$

C $k[NO][NO_3]$

D $k[N_2O_5][NO]$.

20. Which of the following equations represents a step that does **not** occur in the Born Haber cycle for the formation of rubidium iodide?

A $I(g) \rightarrow I^+(g) + e^-$

B $I_2(s) \rightarrow I_2(g)$

C $I(g) + e^- \rightarrow I^-(g)$

D $I_2(g) \rightarrow 2I(g)$

[Turn over

21. By referring to page 9 of the Data Booklet, which of the following is likely to have the highest lattice enthalpy?

A Lithium chloride

B Beryllium chloride

C Sodium chloride

D Magnesium chloride

22. Which of the following has the greatest number of lone pairs of electrons?

A NH_2^-

B NH_4^+

C CH_3^-

D H_3O^+

23. Which molecule contains a bond angle greater than the tetrahedral angle of 109·5°?

A NH_3

B H_2O

C CCl_4

D BF_3

24. Ethanal reacts with an alkaline solution of iodine to form a yellow solid called iodoform, CHI_3. This reaction can be repeated with any compound containing the $CH_3-\overset{\overset{O}{\|}}{C}-$ group **or** one which can be readily oxidised to form this group. Iodoform will **not** be produced when an alkaline solution of iodine reacts with

A ethanol

B propanone

C butan-2-ol

D pentan-3-one.

25. A compound with molecular formula C_3H_8O does not react with PCl_5 and is not readily oxidised by Benedict's or Fehling's solution. The compound could be

A propan-1-ol

B propan-2-ol

C methoxyethane

D ethoxyethane.

26. An organic compound forms an addition product with sodium hydrogen sulphite and another with hydrogen in the presence of a nickel catalyst.

It can be said that the compound definitely

A can be oxidised to an acid

B contains a carbonyl group

C is an alkene

D is an alkanone.

27. In the homologous series of alkanols, increase in chain length from CH_3OH to $C_{20}H_{41}OH$ is accompanied by

A increased volatility and increased solubility in water

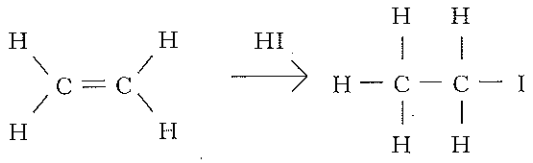
B increased volatility and decreased solubility in water

C decreased volatility and decreased solubility in water

D decreased volatility and increased solubility in water.

Questions 28 and 29 refer to the following.

A



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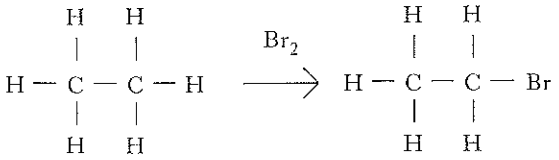

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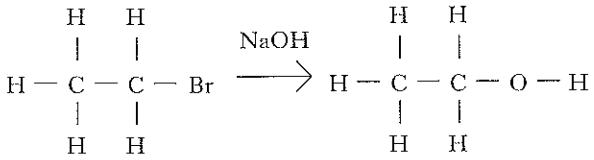

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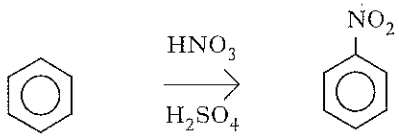
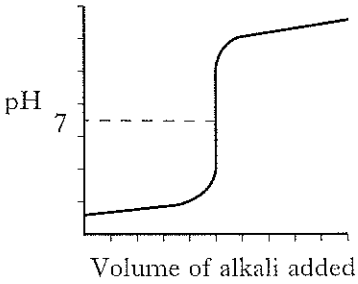


28. In which of the above does the organic compound undergo substitution by an electrophilic species?

29. Which of the above involves homolytic fission?

30. Which of the following graphs represents the change in pH as a strong alkali is added to a weak acid?

A



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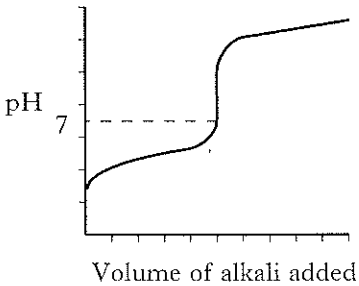

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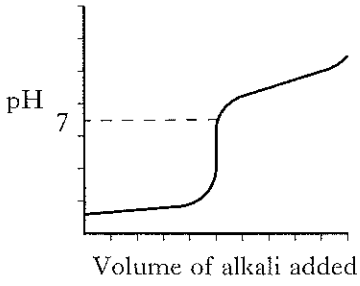
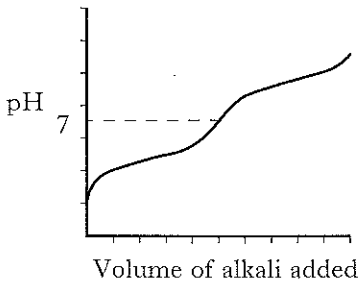


D



31. For the reaction

$$S(s) + 3F_2(g) \rightleftharpoons SF_6(g)$$

$$\Delta G^{\circ}_{\text{(left to right)}} = -983 \cdot 2\,\text{kJ mol}^{-1}$$

which of the following can be deduced with certainty?

A Sulphur and fluorine will react rapidly to form SF_6.

B At equilibrium, the yield of SF_6 will be large.

C The reaction will not occur to any significant extent.

D SF_6 is thermodynamically unstable.

32. Which of the following solutions is **not** a buffer?

A Sodium ethanoate and ethanoic acid

B Ammonium chloride and ammonium hydroxide

C Potassium chloride and potassium hydroxide

D Sodium sulphite and sulphurous acid

33. The enthalpy change for the reaction

$$K^+(g) + F^-(g) \rightarrow K^+(aq) + F^-(aq)$$

is

A the sum of the hydration energies of potassium and fluoride ions

B the enthalpy of formation of potassium fluoride

C the sum of the first ionisation energies of potassium and fluorine

D the enthalpy of solution of potassium fluoride.

34. Which of the following decreases when an aqueous solution of ethanoic acid (1 mol l^{-1}) is diluted? The

A pH

B $[H^+]$

C pKa

D degree of dissociation

35. A solution is made by mixing
100 cm^3 CH_3COOH (0·1 mol l^{-1}) and
100 cm^3 CH_3COONa (0·1 mol l^{-1}).
What will be the effect of diluting this mixture with 500 cm^3 water?

A The concentration and pH will decrease significantly.

B The concentration will decrease and the pH will increase significantly.

C The concentration will decrease but the pH will remain fairly constant.

D The concentration and pH will remain fairly constant.

36. The conversion of a naturally occurring oxide to the chloride is one stage in the extraction of which metal?

A Aluminium

B Iron

C Sodium

D Titanium

37. A solution of ethanoic acid has a pH of 3·4. The concentration of this solution of ethanoic acid ($pK_a = 4·8$) is

A 1·4 mol l^{-1}

B 1·0 mol l^{-1}

C 0·1 mol l^{-1}

D 0·01 mol l^{-1}.

38. For any indicator, the colour change occurs when $pK_{In} = pH$. The equilibrium constant, K_{In}, of an indicator used in an acid/alkali titration where the pH at the end point was 5·2, is

A $6·3 \times 10^{-6}$

B 0·72

C 5·2

D $1·6 \times 10^5$.

39. Which of the following statements is **least** likely to be true of a transition metal M?

A It has a fixed valency (oxidation state) in its compounds.

B Its atoms contain partly filled d orbitals.

C It forms coloured complexes.

D It forms a stable ion M^{2+}.

40. In which of the following compounds is the transition metal in the +3 oxidation state?

A $K_3[Fe(CN)_6]$

B $Na_2[TiCl_6]$

C $K[MnO_3]$

D $[Ni(H_2O)_6]Cl_2$

41. The boxes in the grid below contain reagents used in organic chemistry.

A $Cr_2O_7^{2-}(aq)$ + acid	B HBr	C C_2H_5OH
D CH_3OH	E KCN(aq) + hydrolysis	F Br_2

Identify the reagent which can be used to bring about

(*a*) $C_2H_5COOH \rightarrow C_2H_5COOCH_3$

(*b*) $C_2H_5Br \rightarrow C_2H_5COOH$.

42. The boxes in the grid below contain numbers that can be used in atomic structures.

A 1	B 2	C 3
D 4	E 5	F 6

(*a*) Identify the maximum number of quantum numbers which can be the same for any two electrons.

(*b*) Identify the total number of electrons which may occupy a 2p orbital.

43. The boxes in the grid below contain the symbols for certain elements.

A Ti	B Cr	C Mn
D Co	E Cu	F Zn

(*a*) Atoms of which element(s) do not conform to the Aufbau principle?

(*b*) Atoms of which element(s) have the most unpaired d electrons?

(*c*) Identify an element which does not normally have coloured compounds.

44. The boxes in the grid below contain suggestions for altering the position of the equilibrium

$$2SO_2(g)+O_2(g) \rightleftharpoons 2SO_3(g) \qquad \Delta H^\circ = -197 kJ\ mol^{-1}$$

A Increase the temperature	B Add a catalyst	C Add more SO_2
D Remove some SO_2	E Increase the pressure	F Add more SO_3

Identify **two** ways of moving the equilibrium **to the right**.

Marks

1. 1,2-dichloroethane has been used as a solvent for lacquers and oils. One proposed method of production is the addition of hydrogen chloride to ethyne.

$$C_2H_2 + 2HCl \rightarrow CH_2ClCH_2Cl$$

Compound	$S°/J\,K^{-1}\,mol^{-1}$	$\Delta H°_f / kJ\,mol^{-1}$
C_2H_2	201	227
HCl	187	−92·3
CH_2ClCH_2Cl	208	−166

(*a*) Using the data given in the table above,

(i) calculate the standard entropy change, in $J\,K^{-1}\,mol^{-1}$, for the reaction **1**

(ii) calculate the standard enthalpy change, in $kJ\,mol^{-1}$, for the reaction. **1**

(*b*) The reaction is thermodynamically feasible at room temperature.
Above which temperature will this reaction no longer be feasible? **2**

(4)

2. A green solution of nickel(II) chloride was added to a colourless solution of ammonium tetrafluoroborate producing a pale lilac coloured complex.

(*a*) Write down the electronic configuration for the Ni^{2+} ion. **1**

(*b*) Give a **brief** explanation for the green colour of the nickel(II) chloride solution. **2**

(*c*) Suggest a reason for the change in colour when the two solutions reacted together. **1**

(4)

Marks

3. Sodium sulphite is a reducing agent which is oxidised to sodium sulphate by atmospheric oxygen. In order to determine its purity, a sample of sodium sulphite was analysed as follows.

5·02 g of the sample was dissolved in water and made up to 250 cm^3 in a standard flask. 50 cm^3 of the solution was pipetted into a beaker and treated with excess barium chloride solution to precipitate all the sulphite and sulphate ions as their barium salts as shown in the equations below.

$$Na_2SO_3(aq) + BaCl_2(aq) \rightarrow BaSO_3(s) + 2NaCl(aq)$$

$$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$$

The mixed precipitate was then filtered off, washed with water and dried in an oven to constant mass.

Excess dilute hydrochloric acid was added to the precipitate to dissolve the barium sulphite. The unreacted barium sulphate was then filtered off, washed with water and dried to constant mass.

mass of mixed precipitate	= 1·69 g
mass of barium sulphate	= 0·60 g

(*a*) Calculate the number of moles of barium sulphite in the mixed precipitate. (relative atomic mass of barium = 137) **2**

(*b*) Calculate the percentage by mass of sodium sulphite in the sample. **3**

(*c*) Analysis of sodium sulphite may also be carried out by a volumetric technique using acidified potassium permanganate solution.

Give **two** reasons why acidified potassium permanganate would be a suitable reagent for this analysis. **2**

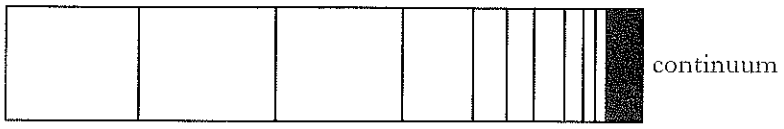
(7)

[Turn over

Marks

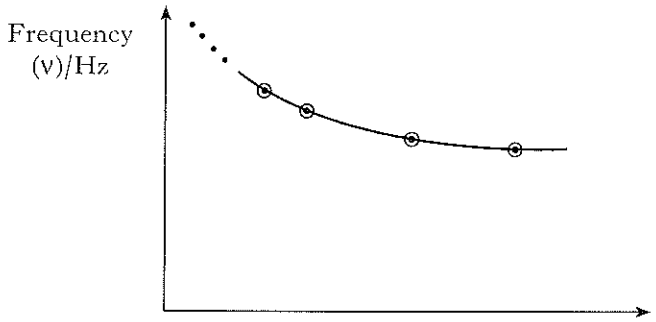
4. The emission spectrum of an element is seen as a series of bright coloured lines on a dark background.

Within a series, the intervals between the frequencies of each line decrease until the lines are so close together that they converge to form a continuous spectrum or continuum as shown in the diagram.



A graphical method can be used to find the start of the continuum.

A plot of ν against $\Delta\nu$ can be extrapolated back to find where $\Delta\nu$ is 0. This is the start of the continuum.



(*a*) What causes a line in an emission spectrum? **1**

(*b*) Why do the lines converge as they reach the continuum? **1**

(*c*) (i) Calculate the energy, in kJ mol^{-1}, of the emission line at the start of the continuum if the curve $\Delta\nu$ intersects the Y-axis (ν) at $1{\cdot}26 \times 10^{15}$ Hz. **2**

(ii) What does this energy represent? **1**

(5)

5. Limewater is a saturated solution of calcium hydroxide. At 20 °C, 100 cm^3 of a limewater solution contained 0·126 g of calcium hydroxide.

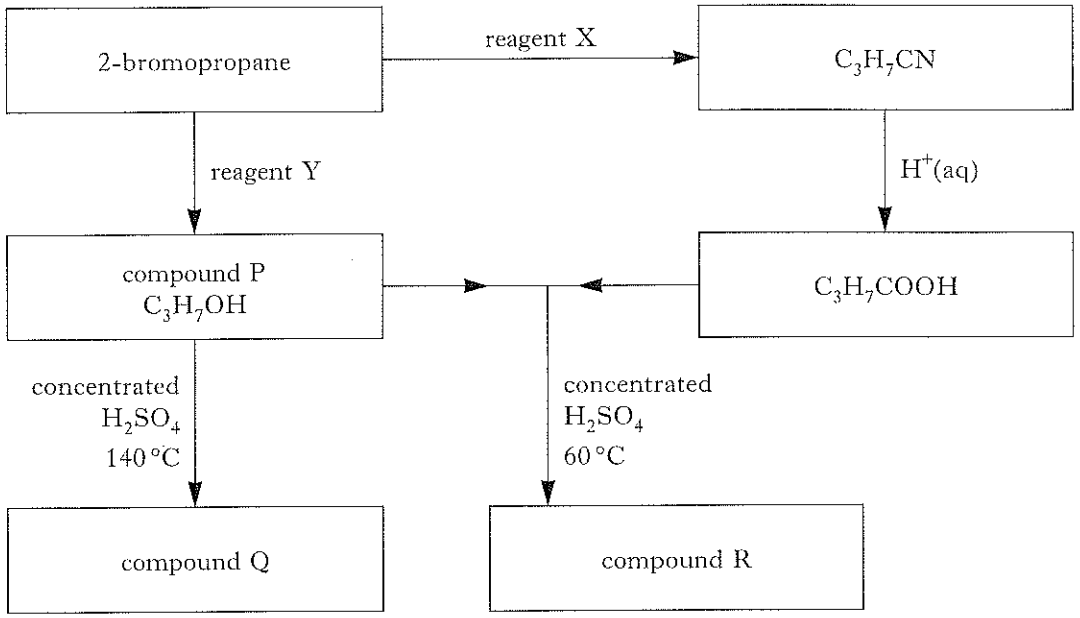
(*a*) Calculate the concentration of hydroxide ions, in mol l^{-1}, in this solution. **2**

(*b*) Using your answer to part (*a*), calculate the pH of the solution. **2**

(4)

Marks

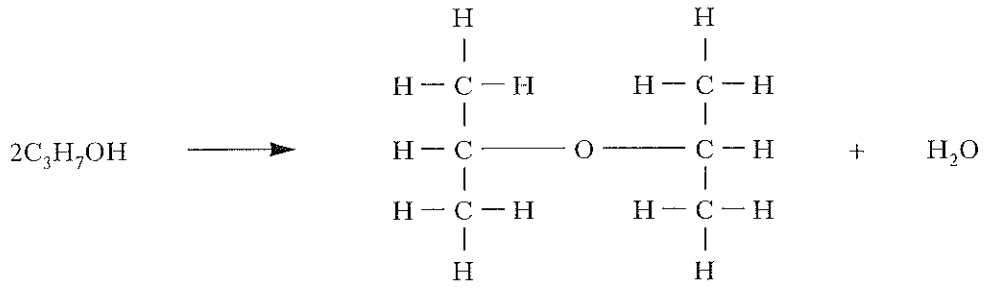
6. Haloalkanes are suitable compounds from which to synthesise other compounds. The flow diagram shows how different compounds can be prepared from 2-bromopropane.



(*a*) Draw the structural formula for 2-bromopropane. **1**

(*b*) Which single term is used to describe reagents X and Y? **1**

(*c*) The equation for the reaction which produces compound Q is



compound Q

To which class of organic compound does Q belong? **1**

(*d*) Draw the structural formula for an isomer of Q which belongs to a different homologous series. **1**

(*e*) Draw the structural formula for compound R. **1**

(*f*) Describe briefly how to distinguish between compounds Q and R. **1**

(*g*) Name the organic compound produced on oxidising compound P with acidified potassium dichromate solution. **1**

(7)

[Turn over

Marks

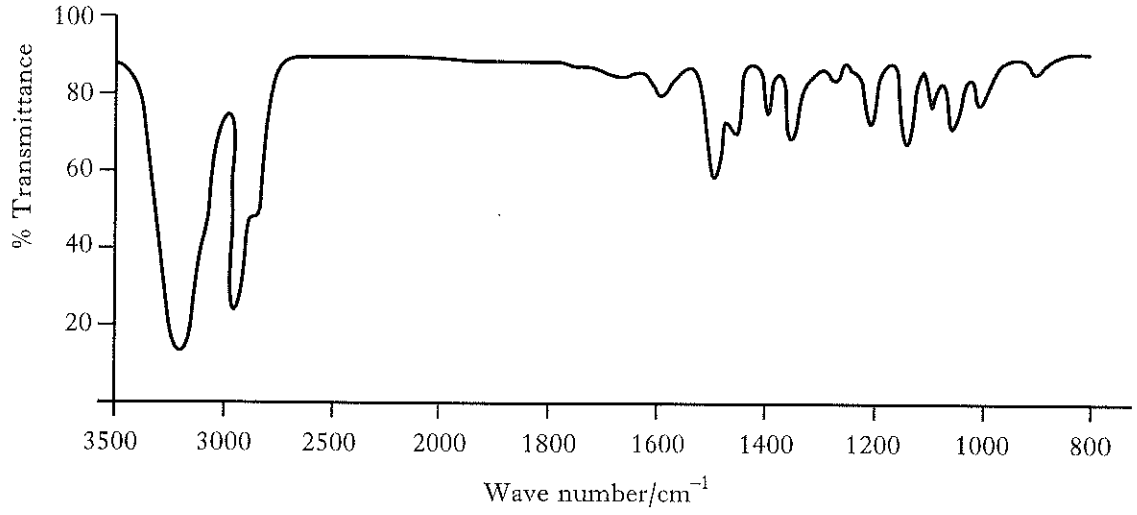
7. Compound X contains, by mass, 69·77% carbon, 11·63% hydrogen and 18·60% oxygen and has a relative molecular mass of 86.

Compound X is a neutral, colourless liquid which reacts slowly with sodium to produce hydrogen gas. X does not immediately decolourise bromine water but decolourises acidified potassium permanganate solution producing compound Y.

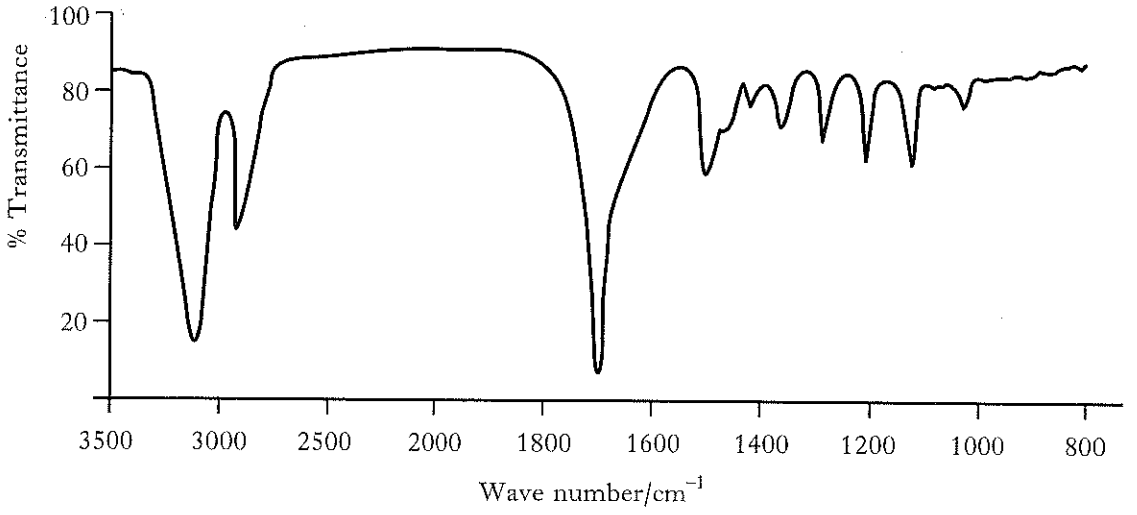
Y reacts with 2,4 dinitrophenylhydrazine to produce a bright yellow solid. This yellow solid can be purified by recrystallisation from hot ethanol.

The infra-red spectra of X and Y are shown below.

Infra-red spectrum of compound X



Infra-red spectrum of compound Y



(*a*) Calculate the empirical (simplest) formula for compound X. **2**

(*b*) Which functional group is present in compound X? **1**

(*c*) Write the molecular formula for compound X and give its systematic name. **2**

(*d*) Which functional group, that is not present in X, is responsible for a major absorption peak in the IR spectrum of Y? **1**

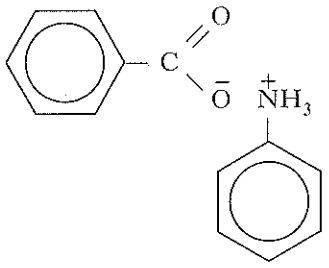
(*e*) Draw the structural formula for Y. **1**

(*f*) Identify an impurity which may have been removed from the yellow solid by the process of recrystallisation. **1**

(8)

Marks

8. Depending on the acid and base from which it is derived, a salt solution may be acidic, neutral or alkaline.



(*a*) Name the acid and base from which the above salt can be made. **2**

(*b*) The values of K_a and K_b for the acid and base are $6{\cdot}3 \times 10^{-5}$ mol l^{-1} and $5{\cdot}0 \times 10^{-10}$ mol l^{-1} respectively. State whether a solution of the salt would be acidic, neutral or alkaline. **1**

(3)

9. The table below refers to the reaction between nitrogen monoxide and hydrogen at a temperature of 1025 K.

$$2NO(g) + 2H_2(g) \rightarrow N_2(g) + 2H_2O(g)$$

Experiment number	Initial concentration of NO/mol l^{-1}	Initial concentration of H_2/mol l^{-1}	Initial rate of formation of N_2/mol l^{-1} s^{-1}
1	0·03	0·005	0·012
2	0·03	0·010	0·024
3	0·03	0·015	0·036
4	0·01	0·015	0·004
5	0·02	0·015	0·016

(*a*) Calculate the order of the reaction with respect to:

(i) hydrogen; **1**

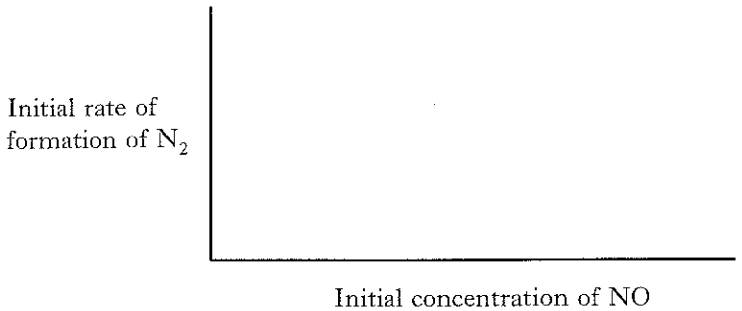
(ii) nitrogen monoxide. **1**

(*b*) Write the rate equation for the reaction. **1**

(*c*) Calculate the rate constant, showing appropriate units. **2**

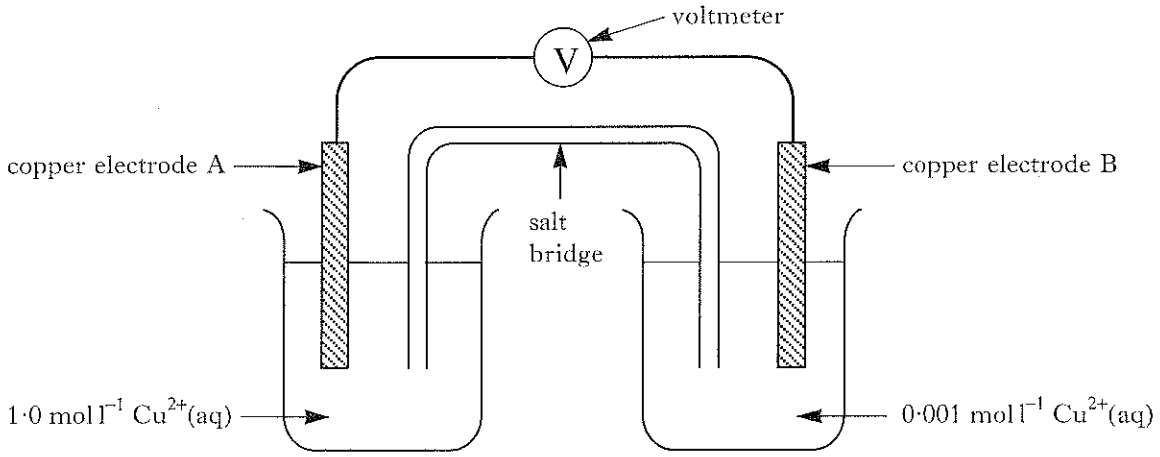
(*d*) Copy the axes given (no graph paper required) and sketch a graph to show how the rate of the reaction varies with concentration of nitrogen monoxide (at constant concentration of H_2). **1**

(6)



Marks

10. The cell shown in the diagram is known as a concentration cell. It is made from two identical copper electrodes (A and B) dipping into two solutions of copper(II) sulphate of different concentrations. When first set up, it produces a voltage of 0·016 volts at 25 °C.



The cell will stop producing a current when the concentrations of the two solutions become identical.

(*a*) What will be the direction of electron flow in the external circuit? **1**

(*b*) Calculate the free energy change in the cell, when first set up. **2**

(3)

11. Iodine can have a number of oxidation states in different compounds. Iodine monochloride, ICl, can be obtained as a dark red oily liquid by passing dry chlorine gas over solid iodine.

$$I_2(s) + Cl_2(g) \rightarrow 2ICl(\ell) \qquad \text{(Reaction A)}$$

If excess chlorine gas is used, the iodine monochloride is converted into iodine trichloride, ICl_3. This is formed as a yellow crystalline solid.

$$ICl(\ell) + Cl_2(g) \rightarrow ICl_3(s) \qquad \text{(Reaction B)}$$

The iodine trichloride reacts with water as shown in the equation.

$$2ICl_3(s) + 3H_2O(\ell) \rightarrow 5HCl(g) + ICl(\ell) + HIO_3(aq) \qquad \text{(Reaction C)}$$

Iodine trichloride also reacts with anhydrous sodium chloride to form the compound $NaICl_4$.

$$NaCl(s) + ICl_3(s) \rightarrow NaICl_4(s) \qquad \text{(Reaction D)}$$

(*a*) Calculate the oxidation state of the iodine in:

(i) ICl_3;

(ii) HIO_3. **2**

(*b*) (i) Which one of the four reactions A, B, C, D is **not** a redox reaction? **1**

(ii) Give another name for the reaction between ICl_3 and water. **1**

(*c*) The ion ICl_4^- is formed in reaction D.

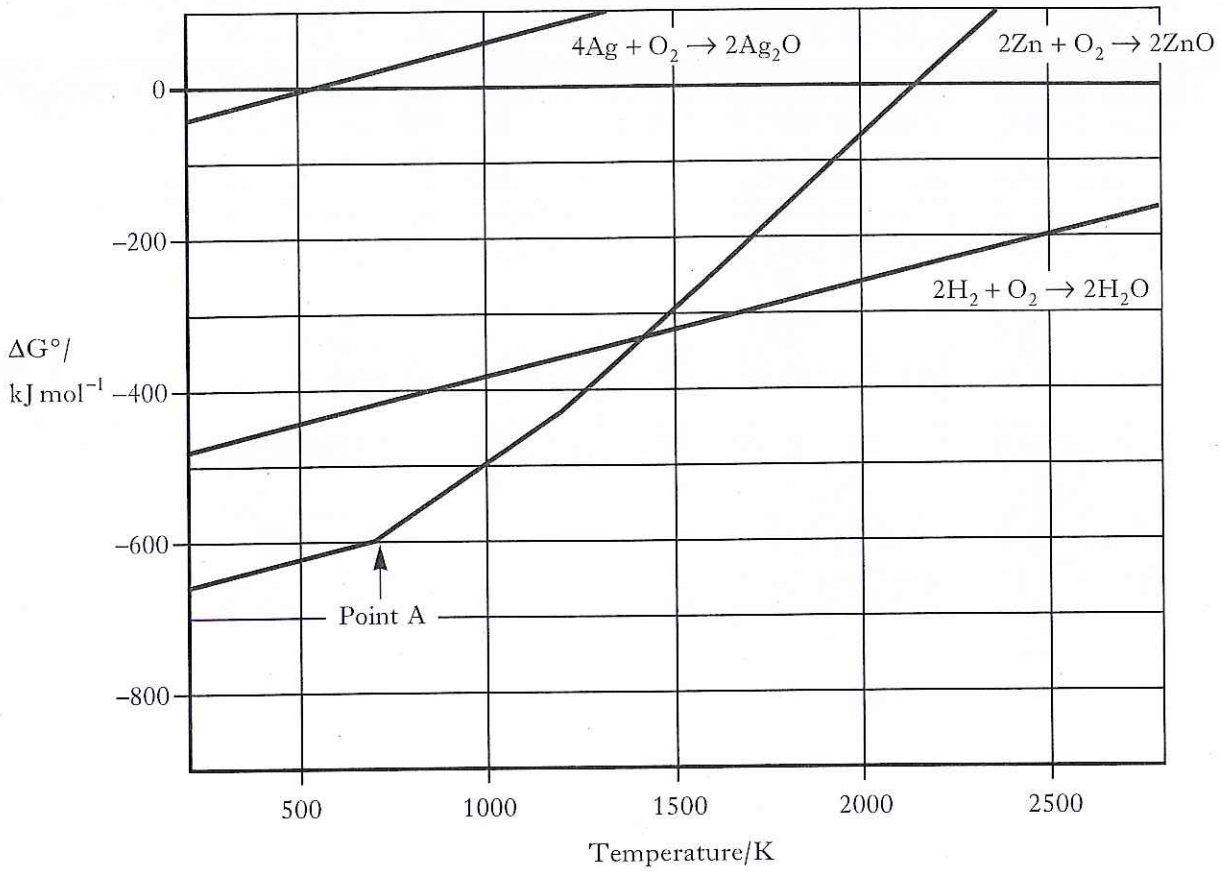
(i) Name this ion. **1**

(ii) Draw the shape of this ion. **1**

(6)

Marks

12. Examine the Ellingham diagram below and answer the questions which follow.



(*a*) At what temperature does the thermal decomposition of zinc oxide become thermodynamically feasible? **1**

(*b*) Write the balanced chemical equation for the reduction of zinc oxide using hydrogen. **1**

(*c*) At what temperature does it become thermodynamically feasible to reduce zinc oxide using hydrogen? **1**

(*d*) The melting point of zinc is approximately 700 K. Explain, in terms of entropy, why the gradient of the graph changes at point A. **2**

(*e*) From the graph, it is thermodynamically feasible to use hydrogen to reduce silver(I) oxide at all temperatures shown. Suggest why this reaction does not occur at room temperature. **1**

(6)

[Turn over

13. Adapted from an article in *Chemistry in Britain*, November 1997 pp50–52.

"Not naughty but nice"

Healthy eating is now very much on consumers' minds. Reduced calorie, low fat foods are being made by companies to replace their "naughty but nice" counterparts.

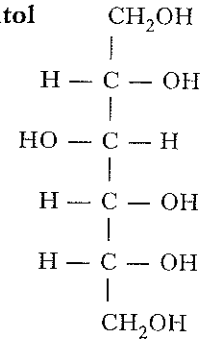
The confectionery industry has faced a tough challenge because its products are based on chocolate, flour and sugar. In order to reduce the energy value of their product, manufacturers are trying to replace some of the sugars. Various compounds have been used in place of sugars. Polyols such as sorbitol (1) and lactitol (2) are used for this purpose. They have energy values of 11·04 kJ per gram but are much less sweet than sugars which have energy values of 18·6 kJ per gram. Intense sweeteners such as acesulfame K (3) or aspartame [Nutrasweet] (4) are used along with polyols to restore the sweetness to that of the standard product.

The use of polyols is not without its problems. If taken in large quantities they can have a laxative effect. Xylitol (5) is one of the sweetest polyols but has an endothermic heat of solution. This does not go well with chocolate but is effective when used in mints.

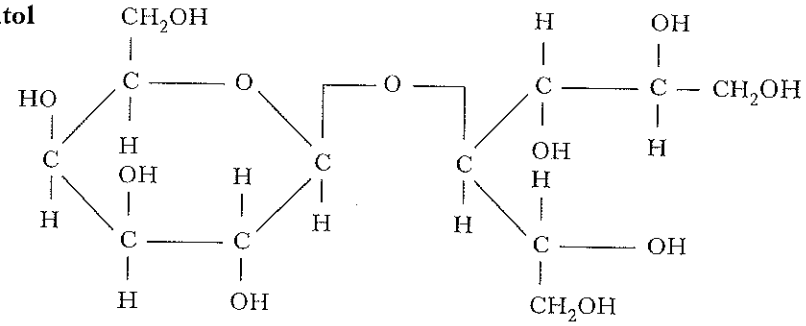
There are also advantages in using polyols. Boiled sweets made from polyols have a longer shelf life than those made from sugars. Also, in the production of boiled sweets, the absence of the browning caused by using sugars is an advantage.

No single sugar substitute is perfect in making low energy foods but in the future erythritol (6) looks like a promising candidate. It has an energy value of only 1·26 kJ per gram. It is rapidly absorbed by the small intestine and excreted unchanged by the kidneys. It remains to be seen if erythritol has any hidden disadvantages.

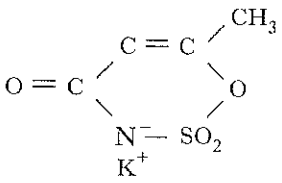
(1) Sorbitol



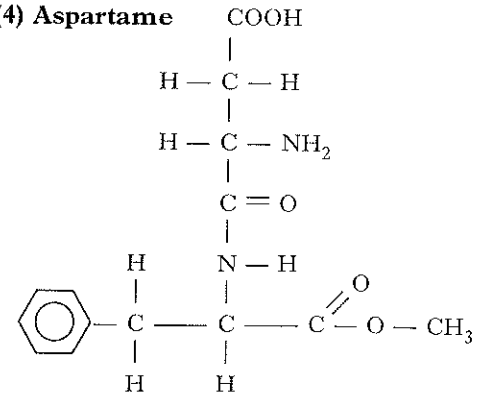
(2) Lactitol



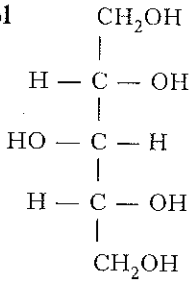
(3) Acesulfame K



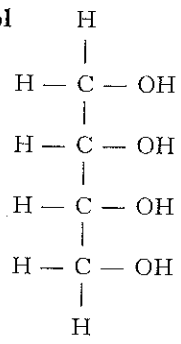
(4) Aspartame



(5) Xylitol



(6) Erythritol



Marks

13. (continued)

(*a*) In the text, sorbitol is referred to as a "polyol".

(i) What is the molecular formula for sorbitol? **1**

(ii) Why is sorbitol **not** classed as a carbohydrate? **1**

(*b*) Why do mints containing xylitol produce a cooling effect in the mouth? **1**

(*c*) Aspartame can be hydrolysed into two amino acids and an alcohol.

(i) Name the alcohol. **1**

(ii) Draw the structural formula for **one** of the amino acids. **1**

(*d*) What would be the systematic name for erythritol? **1**

(*e*) Erythritol is quoted as having an energy value of 1·26 kJ per gram. What is its energy value in kJ mol^{-1}? **1**

(7)

[END OF QUESTION PAPER]