

[0500/318] 1989

CERTIFICATE OF SIXTH YEAR STUDIES

CHEMISTRY

PAPER

Friday, 12th May—9.30 a.m. to 12.00 noon

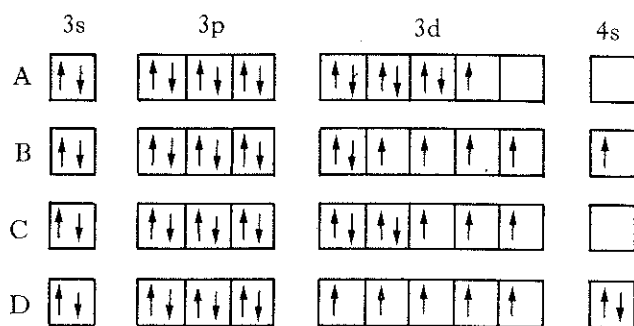


Dalziel High School
Chemistry Department



1989 CSYS

1. Which of the diagrams below correctly represents the distribution of electrons in the outer orbitals of an atom in its ground state?

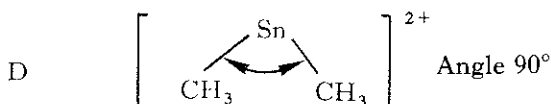
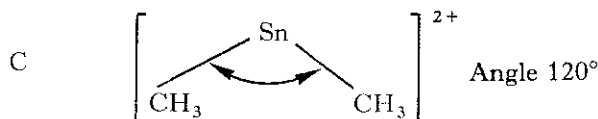
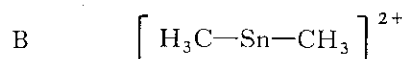
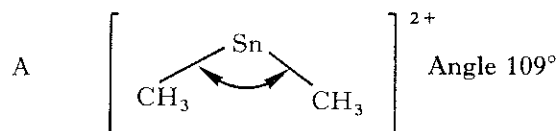


2. The statement that no two electrons can have the same set of all four quantum numbers is known as
- the aufbau principle
 - Heisenberg's uncertainty principle
 - Hund's rule
 - the Pauli exclusion principle.
3. Which type of bonding exists in a solid element which melts above 3800 K and forms a gaseous oxide?
- Covalent (polar)
 - Covalent (non-polar)
 - Metallic
 - Ionic
4. The equilibrium constant for the reaction
- $$\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightleftharpoons \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$$
- at 298 K has a numerical value of 2×10^{37} . Which of the following statements about the reaction is correct?
- The free energy change associated with the reverse reaction has a large negative value.
 - The free energy change associated with the forward reaction has a small negative value.
 - The reverse reaction does not occur to any appreciable extent.
 - The value of the equilibrium constant is not dependent on temperature.

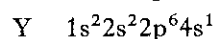
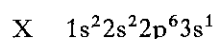
5. Which of the following species has the same shape as an ammonia molecule?

- BH_3
- CH_3^+
- CH_3^-
- CO_3^{2-}

6. Tin can form a positive ion $(\text{CH}_3)_2\text{Sn}^{2+}$. Which of the structures below is the most likely?



7. The electron distributions for two uncharged atoms X and Y are as follows



Which of the following statements is true?

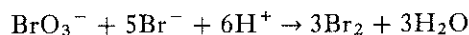
- Energy is released in changing X to Y.
- Atom X is in an excited state.
- Atom Y will ionise more readily than X.
- Both atoms have vacant 2d orbitals.

8. The data below shows the energy required to vaporise the following solids.

sodium chloride	771 kJ mol ⁻¹
ice	50 kJ mol ⁻¹
sodium	109 kJ mol ⁻¹

From this information it can be concluded that

- A ionic bonds are stronger than covalent bonds
 B ionic bonds are stronger than metallic bonds
 C metallic bonds are stronger than covalent bonds
 D covalent bonds are weaker than metallic and ionic bonds.
9. An investigation of the oxidation of bromide ions by bromate(V) ions in acid solution (all concentrations molar) according to



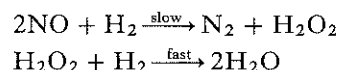
involved the preparation and reaction of several mixtures of equal total volume.

Mixture	$\text{BrO}_3^-/\text{cm}^3$	Br^-/cm^3	H^+/cm^3	$\text{H}_2\text{O}/\text{cm}^3$	Relative Rate
(1)	10	50	60	80	1
(2)	10	100	60	30	2
(3)	10	50	120	20	4
(4)	20	50	60	70	4

If the rate = $k[\text{BrO}_3^-]^x[\text{Br}^-]^y[\text{H}^+]^z$, what values of x, y and z are consistent with experimental data?

- | | | | |
|---|---|---|---|
| | x | y | z |
| A | 1 | 1 | 1 |
| B | 1 | 2 | 1 |
| C | 2 | 2 | 2 |
| D | 2 | 1 | 2 |

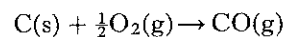
10. The reaction between nitrogen monoxide (NO) and hydrogen to give nitrogen and water occurs by the following steps



The overall order of this reaction will be

- A 1
 B 2
 C 3
 D 4.
11. $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) \quad \Delta H^\circ = -396 \text{ kJ mol}^{-1}$
 $\text{Pb}(\text{s}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{PbO}(\text{s}) \quad \Delta H^\circ = -210 \text{ kJ mol}^{-1}$
 $\text{PbO}(\text{s}) + \text{CO}(\text{g}) \rightarrow \text{Pb}(\text{s}) + \text{CO}_2(\text{g}) \quad \Delta H^\circ = -74 \text{ kJ mol}^{-1}$

What is the value of ΔH° for the following reaction?



- A +112 kJ mol⁻¹
 B -112 kJ mol⁻¹
 C +260 kJ mol⁻¹
 D -260 kJ mol⁻¹
12. 0.0710 g of an unknown chloride gives 0.1435 g of silver(I) chloride when treated with excess aqueous silver(I) nitrate solution. What is the percentage of chloride ion in this unknown?
- A 5
 B 20
 C 25
 D 50
13. Which of the following compounds has the highest degree of ionic character?
- A Sodium fluoride
 B Silicon dioxide
 C Phosphorus pentachloride
 D Hydrogen iodide

[Turn over

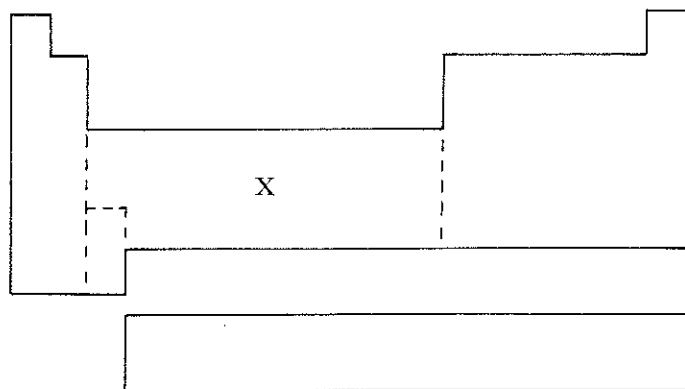
14. The reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ is reversible.

After equilibrium had been established, 1 litre of the reaction mixture was found to comprise 0.2 moles of SO_2 , 0.2 moles of O_2 , and 16 moles of SO_3 .

From this information, which of the following statements is **true**?

- A The value for $K = 400 \text{ l mol}^{-1}$ and $\Delta G^\circ > 0$.
 B The value for $K = 400 \text{ l mol}^{-1}$ and $\Delta G^\circ < 0$.
 C The value for $K = 3.2 \times 10^4 \text{ l mol}^{-1}$ and $\Delta G^\circ > 0$.
 D The value for $K = 3.2 \times 10^4 \text{ l mol}^{-1}$ and $\Delta G^\circ < 0$.

15.



In the periodic table outlined above, one area is marked "X". Moving across area "X", from one element to the next, the extra electron occupies an orbital of type

- A s
 B p
 C d
 D f.

16. $^{231}_{90}\text{Th}$ is a naturally occurring isotope of thorium. It emits β particles and has a half-life of 24.6 hours. Which of the statements below is **true** of a 10 g sample of this isotope?

- A After 49.2 hours, no $^{231}_{90}\text{Th}$ would be left.
 B After 24.6 hours, 5 g of $^{227}_{88}\text{Ra}$ would have been formed.
 C After 49.2 hours, 7.5 g of $^{231}_{90}\text{Th}$ would be left.
 D After 24.6 hours, 5 g of $^{231}_{91}\text{Pa}$ would have been formed.

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

- A $\text{K}(\text{g}) \rightarrow \text{K}^+(\text{g}) + \text{e}^-$
 B $\text{Ni}^{2+}(\text{g}) + 6\text{H}_2\text{O}(\ell) \rightarrow \text{Ni}(\text{H}_2\text{O})_6^{2+}$
 C $\text{Ni}^{2+}(\text{g}) + 2\text{Cl}^-(\text{g}) \rightarrow \text{NiCl}_2(\text{s})$
 D $\text{C}(\text{g}) + 4\text{H}(\text{g}) \rightarrow \text{CH}_4(\text{g})$

18. The yellow colour seen when a sodium salt is heated in a bunsen flame is due to

- A a $d \rightarrow d$ electron promotion absorbing certain wavelengths of visible light
 B a charge transfer mechanism
 C promotion of an electron to a higher shell absorbing certain wavelengths of visible light
 D release of energy as a promoted electron falls to a lower energy level.

19. For which of the following could the associated enthalpy change be described as the lattice formation enthalpy of sodium chloride?

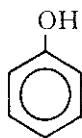
- A $\text{Na}(\text{s}) + \frac{1}{2}\text{Cl}_2(\text{g}) \rightarrow \text{Na}^+\text{Cl}^-(\text{s})$
 B $\text{Na}(\text{g}) + \text{Cl}(\text{g}) \rightarrow \text{Na}^+\text{Cl}^-(\text{s})$
 C $\text{Na}^+(\text{g}) + \text{Cl}^-(\text{g}) \rightarrow \text{Na}^+\text{Cl}^-(\text{s})$
 D $\text{Na}^+\text{Cl}^-(\text{s}) \rightarrow \text{Na}(\text{g}) + \text{Cl}(\text{g})$

20. Which of the following statements about benzene is correct?

- A Benzene readily attracts nucleophilic reagents.
- B The benzene molecule contains carbon-carbon bonds of two different lengths.
- C Benzene does not react with electrophilic reagents.
- D The benzene molecule is planar.

21. Which of the following does **not** react with phosphorus pentachloride?

- A CH_3COOH
- B $\text{C}_2\text{H}_5\text{OH}$
- C



- D $\text{CH}_3\text{COOC}_2\text{H}_5$

22. Which of the following reacts readily with 2,4-dinitrophenylhydrazine?

- A CH_3COCH_3
- B $\text{CH}_3\text{COOCH}_3$
- C CH_3CONH_2
- D $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$

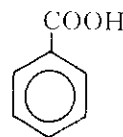
23. Which of the following statements about ethoxyethane is **incorrect**?

- A It burns readily in air.
- B It is isomeric with butan-2-ol.
- C It has a higher boiling point than butan-2-ol.
- D It is a very good solvent for many organic compounds.

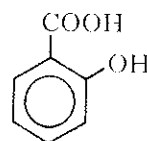
24. A certain compound

- (i) has a pH value of less than 7 when dissolved in water
 - (ii) does not react with aqueous sodium carbonate solution
 - (iii) reacts with sodium, producing hydrogen.
- The compound could be

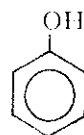
A



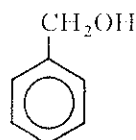
B



C



D

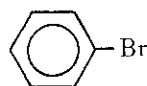


25. Which of the following will **not** react with HCl?

- A Aminoethanoic acid
- B Triethylamine
- C Tetraethylammonium bromide
- D Diethylamine

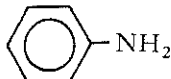
26. Which halide will be most resistant to attack by nucleophilic reagents?

- A $\text{CH}_3\text{C}(\text{CH}_3)_2\text{Cl}$
- B $\text{CH}_3\text{CH}_2\text{Br}$
- C $\text{CH}_3\text{CH}(\text{Cl})\text{CH}_3$
- D



[Turn over

27. Which of the following is the strongest base?

- A NH_3
- B $\text{CH}_3\text{CH}_2\text{NH}_2$
- C CH_3CONH_2
- D 

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

- A Alcohols are used widely in industry as solvents.
- B Detergents can only be made from animal fats and vegetable oils.
- C Glycerol is used in the manufacture of explosives.
- D Methanal is used in the manufacture of condensation polymers.

29. Which of the following equimolar aqueous solutions would have the highest pH value?

- A $(\text{NH}_4)_2\text{SO}_4$
- B LiNO_3
- C CH_3COONa
- D Na_2CO_3

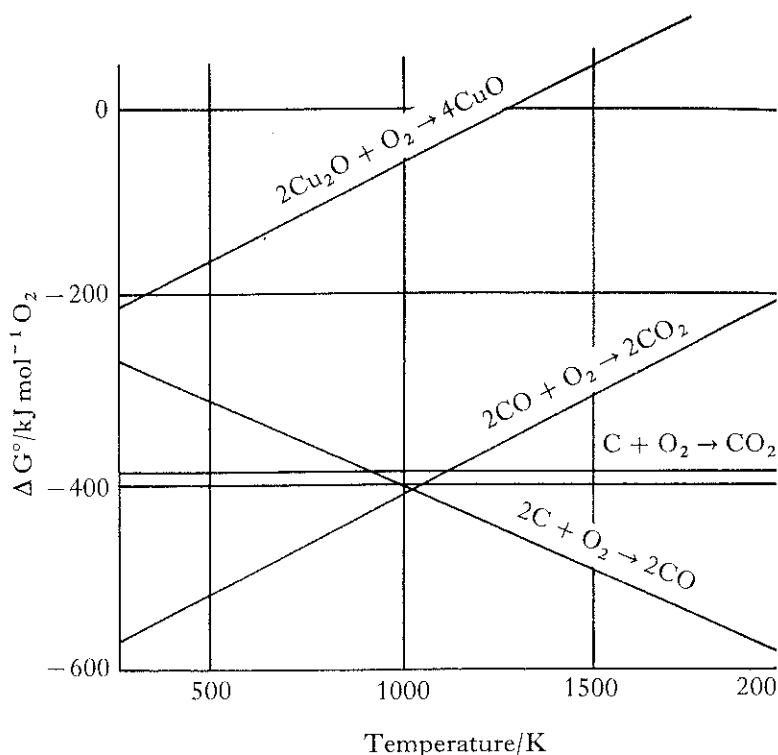
30. The transition metal salts $\text{Mn}^{2+}(\text{F}^-)_2$, $\text{Fe}^{2+}(\text{F}^-)_2$, $\text{Co}^{2+}(\text{F}^-)_2$ have identical crystal structures because the metal ions have

- A the same nuclear charge
- B similar colours
- C the same number of d electrons
- D similar radii.

31. Which of the following involves oxidation of the metal?

- A $\text{Ag}^+ \rightarrow [\text{Ag}(\text{NH}_3)_2]^+$
- B $\text{MnO}_4^- \rightarrow \text{MnO}_4^{2-}$
- C $[\text{Fe}(\text{CN})_6]^{4-} \rightarrow [\text{Fe}(\text{CN})_6]^{3-}$
- D $[\text{Ni}(\text{H}_2\text{O})_6]^{2+} \rightarrow [\text{Ni}(\text{CN})_4]^{2-}$

Questions 32 and 33 refer to the following graph.



32. At 1500 K, which reaction is more feasible than the formation of carbon dioxide from its elements?

- A $2\text{Cu}_2\text{O} + \text{O}_2 \rightarrow 4\text{CuO}$
- B $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$
- C $2\text{C} + 2\text{O}_2 \rightarrow 2\text{CO}_2$
- D $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$

33. The main reason for the almost constant value of ΔG° at different temperatures for the reaction $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ is that for the reaction

- A ΔS° is almost zero
- B ΔS° is approximately equal to ΔH°
- C ΔH° is almost zero
- D both ΔS° and ΔH° are almost zero.

34. A monoprotic acid has a dissociation constant $K_a = 3 \times 10^{-5} \text{ mol l}^{-1}$. The approximate pH of a 0.1 M solution of this acid will be
- 1.76
 - 2.76
 - 3.52
 - 5.52.
35. Which of the following could be used to produce an aqueous buffer solution?
- NaH_2PO_4 and Na_2HPO_4
 - CH_3COOH and NaCl
 - NH_3 and CH_3NH_2
 - HNO_3 and NaNO_3
36. In terms of the quantity of each metal manufactured worldwide, which sequence is in the correct order?
- $\text{Al} > \text{Fe} > \text{Mg} > \text{Ti}$
 - $\text{Fe} > \text{Al} > \text{Ti} > \text{Mg}$
 - $\text{Fe} > \text{Ti} > \text{Al} > \text{Mg}$
 - $\text{Al} > \text{Mg} > \text{Fe} > \text{Ti}$
37. A green hydrated ion has four unpaired electrons in its 3d orbitals. The ion is
- V^{3+}
 - Fe^{2+}
 - Cr^{3+}
 - Ni^{2+} .

To answer **Questions 38 to 40** use the following code.

If all the responses 1, 2 and 3 are correct, select A.

If only 1 and 2 are correct, select B.

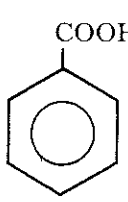
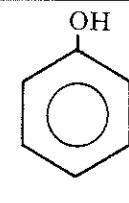
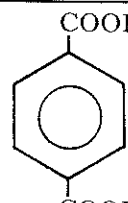
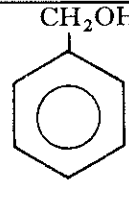
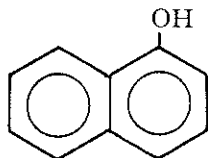
If only 3 is correct, select C

Otherwise select D.

38. The voltage of a cell can be affected by changes in the
- 1 concentration of cell solution(s)
 - 2 pressure of the gas in a gas electrode
 - 3 temperature.
39. During which of the following is it likely that an organic compound would be decomposed?
- 1 Infra-red spectroscopy
 - 2 Colorimetry
 - 3 Mass spectrometry
40. For the equilibrium
- $$\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$$
- K_p at 327 K is $1.78 \times 10^4 \text{ mol l}^{-1}$
and K_p at 727 K is $2.82 \times 10^4 \text{ mol l}^{-1}$.
- Which of the following statements is (are) correct?
- 1 ΔH° (left to right) is negative.
 - 2 The formation of NO_2 is favoured by an increase in pressure.
 - 3 The formation of NO_2 is favoured by an increase in temperature.

[END OF QUESTION PAPER]

1. The formulae for certain compounds are shown below. Unless otherwise stated, all the questions are about the compounds shown. The answer to each question will be a letter (or group of letters) corresponding to the box(es) in the grid. A box may be used more than once in different answers. **Correct boxes, and no more, are required to obtain each mark.**

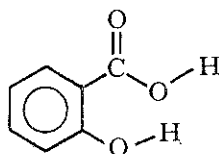
CH_3COOH A	 B	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ C
 D	 E	 F
CCl_3COOH G	 H	$\begin{array}{c} \text{CH}_2\text{OH} \\ \\ \text{CH}_2\text{OH} \end{array}$ I

- (a) Which of the non-aromatic compounds is the strongest acid? 1
- (b) Which compound(s) will **not** release $\text{H}^+(\text{aq})$ in water? 1
- (c) Which compounds, when allowed to react together, will form a polyester? 1
- (d) Which compound can be oxidised to form another compound in the grid? 1
- (e) Which compound(s) can be dehydrated to give a compound (not in the grid) which will decolourise bromine water? 1

(5)

2. Answer EITHER A OR B.

A.



- (a) Explain why, in the above compound,
- (i) the phenolic group is acidic, 1
 - (ii) the carboxyl group is more acidic ($pK_a = 2.97$) than the phenolic group ($pK_a = 13.4$), 1
 - (iii) the phenolic group is even less acidic ($pK_a = 13.4$) than phenol itself ($pK_a = 10.0$). 1
- (b) State the numerical value of K_a for a dilute solution of phenol. 1

(4)

OR

- B. The tables below give the first ionisation energies (in kJ mol^{-1}) for the elements of periods 2 and 3.

Li	Be	B	C	N	O	F	Ne
526	905	807	1090	1410	1320	1690	2090

Na	Mg	Al	Si	P	S	Cl	Ar
502	744	584	792	1020	1010	1260	1530

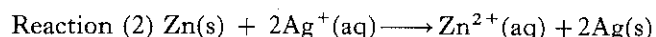
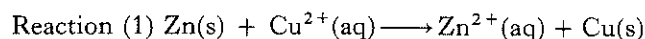
Why is there

- (a) in general, a gradual increase of ionisation energy from left to right across a period? 2
- (b) a general decrease of ionisation energy down a group? 1
- (c) an exception to the trend across a period at, for example, Be and Mg? 1

(4)

[Turn over

3.



$\Delta H^{\circ}/\text{kJmol}^{-1}$	$\Delta S^{\circ}/\text{JK}^{-1}\text{mol}^{-1}$
-216.8	-15.5
-364.5	-210.5

- (a) Using the given data, show which of the above reactions is thermodynamically more favoured at 298K.
- (b) If Reaction (1) were to be used in an electrochemical cell operating at 350K, what would you predict would be the e.m.f. of the cell under standard conditions for ionic concentrations?
- (c) Account for the difference in the ΔS° values for Reactions (1) and (2).

2
4
1
(7)

4. Answer **EITHER A OR B.**

A. Magnesium ions can be estimated by titration with a solution of disodium ethylenediaminetetraacetate (EDTA). The latter can be represented by the symbols $2\text{Na}^{+} + (\text{H}_2\text{Y})^{2-}$.



In an experimental analysis of an impure sample of magnesium metal, 0.200 g of the metal was dissolved in dilute hydrochloric acid. The resulting solution was then evaporated to dryness, and the residue dissolved in water and made up to 2 litres with more water. 25 cm³ of this solution were pipetted into a conical flask and diluted by addition of water. 10 cm³ of a buffer solution were added along with 0.5 cm³ of a dyestuff indicator solution. Titration with 0.01 M solution of EDTA required 10 cm³ to the end point.

- (a) Calculate the purity of the magnesium.
- (b) Suggest why the added buffer is alkaline.
- (c) Suggest a reason why magnesium ions rather than sodium ions combine preferentially with EDTA.
- (d) Why is only a very small amount of indicator added?

4
1
1
1
(7)

OR

B. An anhydrous salt was thought to be a mixture of magnesium sulphate and magnesium chloride. 0.600 g of the salt was dissolved in 250 cm³ of water, heated, and a hot dilute solution of barium chloride added very slowly until no further precipitate appeared. The mixture was cooled and filtered using an ashless filter paper. The precipitate was washed with water until a portion of the filtrate gave no cloudiness on addition of a few drops of silver nitrate. After drying, the filter paper and the precipitate were incinerated, cooled, and weighed. This process was repeated until constant weight was attained. The precipitate then weighed 1.146 g. (Relative atomic mass of barium = 137)

- (a) Calculate the percentage by weight of magnesium sulphate in the sample.
- (b) What is the object of the test on the filtrate?
- (c) What precaution must be taken while the incinerated precipitate is being cooled?
- (d) Why is ashless filter paper used?

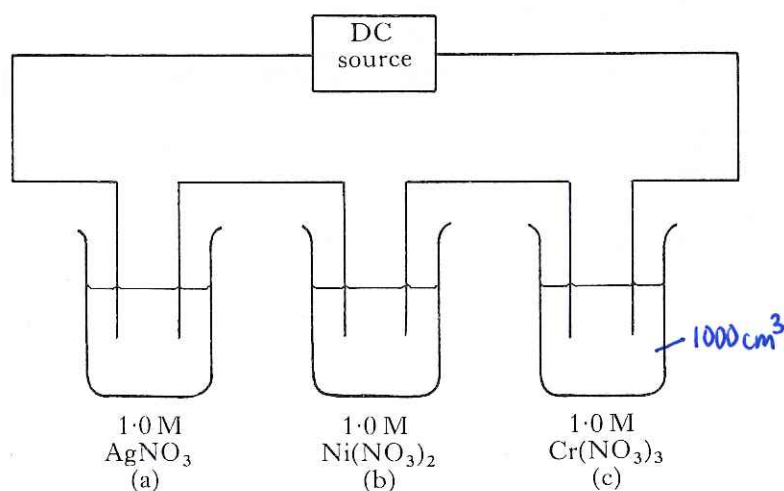
4
1
1
1
(7)

5. (a) In aqueous solution, the complex ion $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ has an available unoccupied energy level 239 kJ mol^{-1} above the highest occupied level. What wavelength of light will bring about the transition from the lower to the upper level? 3
- (b) Using the spectral line data given on page 12 of the Data Book, state the colour to which the wavelength in (a) above corresponds. Hence deduce the observed colour of the solution in daylight. 2

(5)

6. Answer **EITHER A OR B.**

A. The following electrolytic cells were set up using platinum electrodes.



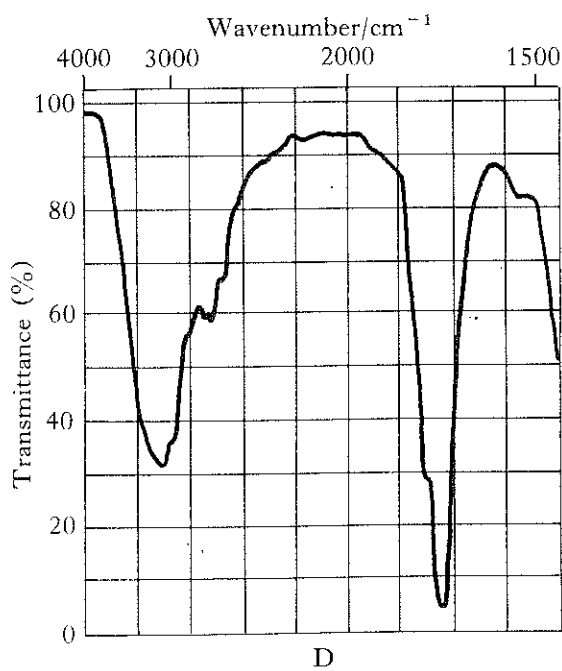
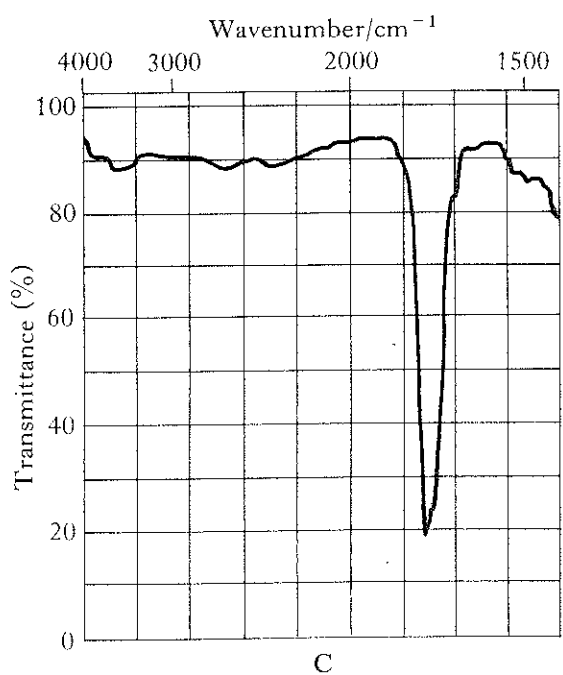
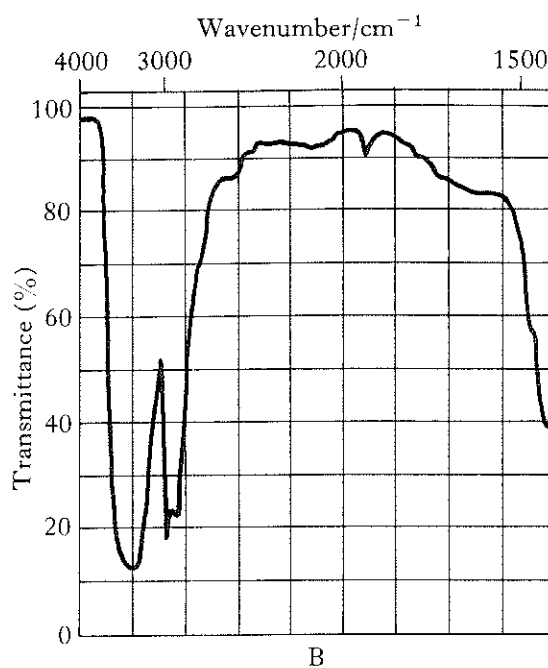
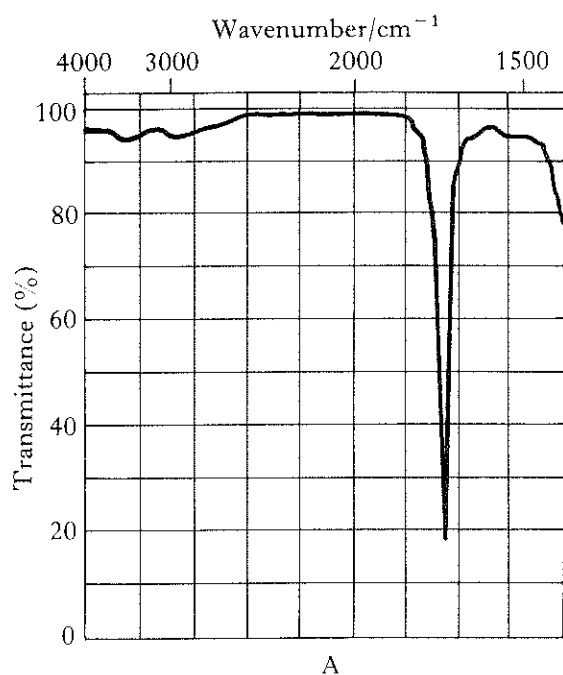
What is the molarity of salt in each cell after 9,650 coulombs have been passed through the system? (The Faraday constant = $96,500 \text{ coulombs mol}^{-1}$) (3)

OR

- B. The stretching of an elastic band is an exothermic process but the opposite process is endothermic. Why is the latter process thermodynamically feasible? (3)

[Turn over

7.



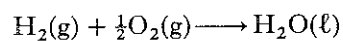
The infrared spectra A–D shown above refer to ethanol, propanone, ethanal, and ethanoic acid but not necessarily in that order.

- (a) Draw the full or extended structural formulae for ethanol, propanone, ethanal, and ethanoic acid. 2
- (b) Examine the spectra carefully and identify, with full reasoning, the spectra of
- (i) ethanoic acid,
 - (ii) ethanol. 5
- (7)

8. (a) What does the standard free energy change (ΔG°) for a chemical reaction signify?

1

(b) Using the data given in the table below, calculate ΔG° for the reaction



at 298 K and 1 atmosphere pressure.

	$\Delta H_f^\circ/\text{kJ mol}^{-1}$	$S^\circ/\text{JK}^{-1}\text{mol}^{-1}$
$\text{H}_2(\text{g})$	0	131
$\text{O}_2(\text{g})$	0	205
$\text{H}_2\text{O}(\ell)$	-286	70

4

(c) How do you reconcile your result with the fact that this reaction does not normally proceed at room temperature?

1

(6)

[Turn over

9. Answer EITHER A OR B.

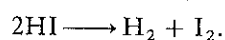
- A. During the study of the spontaneous decomposition of a radioactive nuclide the following data were obtained.

Rate of decay/mol l ⁻¹ s ⁻¹	Concentration of Nuclide/mol l ⁻¹
1.18 × 10 ⁻²	2.81 × 10 ⁻²
0.86 × 10 ⁻²	2.04 × 10 ⁻²
0.79 × 10 ⁻²	1.88 × 10 ⁻²
0.55 × 10 ⁻²	1.32 × 10 ⁻²

- (a) Using the above data, deduce the order of the process. 2
- (b) What is the rate constant for the decomposition? 2
- (c) How would an increase in temperature affect the rate of decay? Explain your answer. 2
- (6)

OR

- B. At elevated temperatures, gaseous hydrogen iodide, HI, decomposes as follows



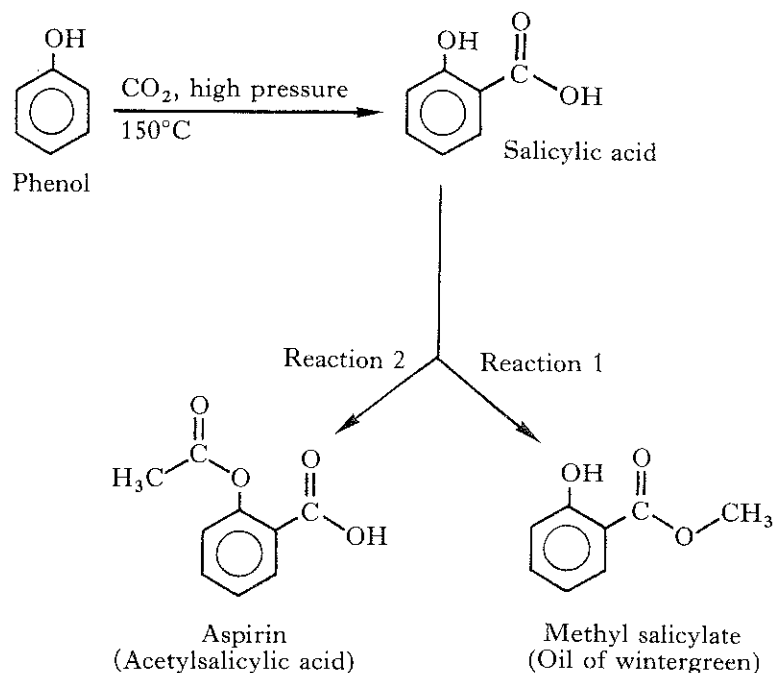
The rate of the reaction was studied at a constant temperature and the following data were obtained.

Initial Rate of Reaction/mol l ⁻¹ s ⁻¹	Initial Concentration of HI/mol l ⁻¹
0.051	1.2 × 10 ⁻²
0.034	0.98 × 10 ⁻²
0.026	0.86 × 10 ⁻²
0.019	0.73 × 10 ⁻²

- (a) Why was the reaction studied at a constant temperature? 1
- (b) What is the order of the reaction? Justify your answer. 2
- (c) What is the rate constant for the above conditions? 2
- (d) If the initial concentration made up as shown in column two had a small amount of hydrogen gas added before raising to the reaction temperature, what effect would this have on the initial rate at the reaction temperature? 1
- (6)

10. (a) What is meant by the term pH? 1
- (b) What is the pH of a 0.01M solution of hydrochloric acid? 1
- (c) What assumption about the acid is made in calculating the pH value in (b)? 1
- (d) Calculate the pH of a 0.01M solution of ethanoic acid, assuming its dissociation constant K_a is 1.8 × 10⁻⁵. 3
- (e) What assumption is made in calculating the pH value in (d)? 1
- (f) What would happen to the pH of the ethanoic acid solution if solid sodium ethanoate were added? Explain your answer. 2
- (9)

11. Study the reaction sequence given below.



- | | |
|---|------------|
| (a) What chemical compound is the usual starting material for the preparation of phenol? | 1 |
| (b) Which reagent(s) will be involved in Reaction 1? | 2 |
| (c) To which class of substances does methyl salicylate belong? | 1 |
| (d) Reaction 2 is brought about by reaction of salicylic acid with ethanoic anhydride. Write an equation for this reaction, given that ethanoic acid is a by-product. | 1 |
| (e) Disprin is a soluble form of aspirin. Can you suggest how aspirin might be turned into a soluble form? | 1 |
| (f) Name another useful group of substances derived from phenol. | 1 |
| | (7) |

[Turn over

- | | <i>Marks</i> |
|---|--------------|
| 12. (a) (i) Give the systematic name of the ion $[\text{Fe}(\text{CN})_6]^{3-}$. | 1 |
| (ii) What is the geometrical arrangement of ligands round the iron? | 1 |
| (b) The neutral complex $\text{PtCl}_2(\text{NH}_3)_2$ has two isomers. | |
| (i) Will the ligand arrangement be tetrahedral or square planar? | 1 |
| (ii) Draw these two isomers. | 2 |
| (c) There are three structural isomers of the compound $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$. The first reacts with silver ions in solution in molar ratio of 1 : 3. The second reacts in ratio 1 : 2 and the third reacts in a 1 : 1 ratio. | |
| (i) Why do these isomers react in different ratios with silver ions? | 1 |
| (ii) Give the formula for the positive complex ion of the third isomer. | 1 |
| | (7) |

13. Answer **A OR B OR C**

- A.** Describe the processes involved when ionic substances dissolve in water, including the enthalpy and entropy changes. **(4)**

OR

- B.** Compare and contrast, with examples, the reactions of the functional groups



OR

- C.** Comment on four methods available to a chemist for checking the purity of a substance. **(4)**

[END OF QUESTION PAPER]