1990

CHEMISTRY

YEAR 12

TRIAL EXAM

CHEMISTRY ASSOCIATES
P.O. BOX 2227
KEW, VIC., 3101
AUSTRALIA
TEL:(03) 9817 5374 FAX: (03) 9817 4334

email: chemas@vicnet.net.au

Internet: http://www.vicnet.net.au/~chemas/education.htm

CANDIDATE'S NAME_____

CHEMISTRY ASSOCIATES

YEAR 12 CHEMISTRY TRIAL EXAMINATION 1990
(not to be used before Wednesday August 1, 1990)
Time allowed for examination = 3 hours.

MULTIPLE CHOICE ANSWER SHEET SECTION A

Instructions:(1) Mark letters with a single pencil line
EXAMPLE A B ~~C~~ D
(2) Completely erase any mistakes.
(3) One and only one letter should be marked for each item

(1)	A	B	C	D	(20)	A	B	C	D
(2)	A	B	C		(21)	A	B	C	D
(3)	A	B	C	D	(22)	A	B	C	D
(4)	A	B	C	D	(23)	A	B	C	D
(5)	A	B	C	D	(24)	A	B	C	D
(6)	A	B	C	D	(25)	A	B	C	D
(7)	A	B	C	D	(26)	A	B	C	D
(8)	A	B	C	D	(27)	A	B	C	D
(9)	A	B	C	D	(28)	A	B	C	D
(10)	A	B	C	D	(29)	A	B	C	D
(11)	A	B	C	D	(30)	A	B	C	D
(12)	A	B	C	D	(31)	A	B	C	D
(13)	A	B	C	D	(32)	A	B	C	D
(14)	A	B	C	D	(33)	A	B	C	D
(15)	A	B	C	D	(34)	A	B	C	D
(16)	A	B	C	D	(35)	A	B	C	D
(17)	A	B	C		(36)	A	B	C	D
(18)	A	B	C	D	(37)	A	B	C	D
(19)	A	B	C	D	(38)	A	B	C	D

DETACH THIS ANSWER SHEET AT THE START OF THE EXAMINATION

CHEMISTRY ASSOCIATES CANDIDATE'S NAME _____

YEAR 12 CHEMISTRY TRIAL EXAMINATION 1990

Time allowed for examination = 3 hours

Structure of examination paper: Number of booklets = 1
Number of Sections = 2

SECTION	NUMBER OF QUESTIONS	NUMBER OF QUESTIONS TO BE ANSWERED	PERCENTAGE OF EXAMINATION
A	1 (38 items)	1 (38 items)	35
B	10 (numbered 2 to 11)	10 (numbered 2 to 11)	65

There is a Multiple Choice Answer Sheet attached to the front of this booklet.

DIRECTIONS TO CANDIDATES

(1) Answer ALL questions.

(2) Section A questions must be answered on the Multiple Choice Answer Sheet provided.

(3) Section B questions must be answered in the spaces provided.

(4) Approved calculators may be used.

(5) To answer certain questions, you may need to refer to the data sheet on the back of this page.

(6) At the end of the examination, place the Multiple Choice Answer Sheet inside the back cover of this booklet and hand them in.

(7) Please ensure that you write your name on this booklet AND on the Multiple Choice Answer Sheet.

SPECIFIC INSTRUCTIONS FOR SECTION A

(1) Section A, Question 1, consists of 38 multiple choice items and is worth 38 marks and therefore 33% of the total marks available for this examination.You should therefore spend about 60 minutes on Section A.

(2) Choose the response you consider is correct or best, and mark your choice on the Multiple Choice Answer Sheet according to the instructions on that sheet.

(3) A correctly answered item scores 1, an incorrect item scores 0. No credit will be given for an item if two or more letters are marked for that item. Marks will NOT be deducted for incorrect answers and you are urged to attempt every item.

(4) Jottings should be done in the WORKING SPACES in this booklet.

DATA

TABLE 1: RELATIVE ATOMIC MASS ($^{12}C = 12.00$)

Element	Symbol	Atomic No.	Relative Atomic Mass
Silver	Ag	47	107.9
Aluminium	Al	13	27.0
Barium	Ba	56	137.3
Bromine	Br	35	79.9
Calcium	Ca	20	40.1
Carbon	C	6	12.0
Chlorine	Cl	17	35.5
Copper	Cu	29	63.5
Hydrogen	H	1	1.0
Magnesium	Mg	12	24.3
Nitrogen	N	7	14.0
Sodium	Na	11	23.0
Oxygen	O	8	16.0
Phosphorus	P	15	31.0
Sulfur	S	16	32.1
Strontium	Sr	38	87.6
Zinc	Zn	30	65.4

TABLE 2: E^{o} values at 298 K

Half reaction	E^{o}/V
$Ag^{+}(aq) + e^{-} = Ag(s)$	+0.80
$Cu^{2+}(aq) + 2e^{-} = Cu(s)$	+0.34
$2H^{+}(aq) + 2e^{-} = H_2(g)$	0.00
$Zn^{2+}(aq) + 2e^{-} = Zn(s)$	-0.76

TABLE 3: PHYSICAL CONSTANTS

Avogadro Constant (N_A)	6.023×10^{23} mol^{-1}
Faraday Constant (F)	96 500 C mol^{-1}
Gas Constant (R)	8.31 J K^{-1} mol^{-1}
Molar Volume of gas at STP	22 400 cm^3 mol^{-1} = 22.4 dm^3 mol^{-1}
Pressure	1 atmosphere = 101 325 Pa

Item 1
An ion formed by a metal will have
A. the same number of protons and electrons.
B. more protons than electrons.
C. the same number of protons and neutrons.
D. more electrons than protons.

Item 2
The combustion of the hydrocarbon octane, C_8H_{18}, is given by the equation:

$$2C_8H_{18}(l) + 25O_2(g) = 16CO_2(g) + 18H_2O(g) ; \quad \Delta H = -10{,}900 \text{ kJ mol}^{-1}$$

When 114 g of octane is burnt with excess oxygen, the energy released would be
A. 5450 kJ.
B. 10,900 kJ.
C. 21,800 kJ.

Item 3
According to the theory of nucleogenesis, all of the elements heavier than iron were formed
A. during the gravitational collapse of a hydrogen gas cloud.
B. before the formation of helium.
C. during a supernova explosion.
D. immediately after the formation of iron.

Item 4
Which one of the following statements is correct?
Transition metals
A. have high melting points.
B. form white oxides.
C. cannot be magnetized.
D. show only one specific oxidation state.

Item 5
The element which forms the most stable nucleus is
A. iron
B. hydrogen
C. silicon
D. helium

Item 6
Methyl benzene can be produced by the action of chloromethane on benzene in the presence of a catalyst such as aluminium chloride. The molecular formula of methyl benzene is
A. $C_6H_5CH_4$
B. $C_6H_5CH_3$
C. $C_6H_6CH_4$
D. $C_6H_6CH_3$

Item 7
Of the following, the compound with the SMALLEST percentage by mass of nitrogen is
A. NH_4NO_3
B. $(NH_4)_2SO_4$
C. NH_3
D. $NaNO_3$

Item 8
When 5 cm^3 of 0.01M sodium hydroxide is mixed with 15 cm^3 of 0.03M sodium hydroxide, the molarity of the resulting solution is
A. 0.015
B. 0.025
C. 0.035
D. 0.045

Item 9
In the partial ionic equation, $Cr_2O_7^{2-} + 14H^+ + 6e^- = 2Cr^{3+} + 7H_2O$,
the change in the oxidation number of the element chromium is
A. +6 to +3
B. +8 to +6
C. +12 to +6
D. +8 to +3

Item 10
In the partial ionic equation,

$$2MnO_2(s) + 2NH_4^+(aq) + 2e^- = Mn_2O_3(s) + 2NH_3(aq) + H_2O(l)$$

the change in the oxidation number of the element manganese is
A. +2 to +3
B. +4 to +5
C. +4 to +3
D. +1 to +2

Item 11
Iron(III) oxide (relative formula mass = 159.7) is reduced to metallic iron using aluminium powder as a reductant according to the equation:
$Fe_2O_3(s) + 2Al(s) = 2Fe(l) + Al_2O_3(s)$
If 10 g of Fe_2O_3 is reacted with 10 g of Al, then
A. Al is in excess by 6.6 g
B. Al is in excess by 8.3 g
C. Fe_2O_3 is in excess by 8.3 g
D. Fe_2O_3 is in excess by 6.6 g

Item 12
If the relative atomic mass of an element is 40.00 and it consists of two naturally occurring isotopes, one of which has a percentage abundance of 67.00% and a relative isotopic mass of 40.50, the relative isotopic mass of the other isotope is
A. 39.00
B. 39.25
C. 39.50
D. 39.75

Item 13
Nitric acid can be manufactured from the element nitrogen using the steps:

1 **2** **3** **4**
$N_2 \text{-------} \rightarrow NH_3 \text{-------} \rightarrow NO \text{-------} \rightarrow NO_2 \text{-------} \rightarrow HNO_3$

The step in which there is the GREATEST CHANGE in the oxidation number of nitrogen is
A. **1**
B. **2**
C. **3**
D. **4**

Item 14
On spacecraft the cabin atmosphere can be cleansed of carbon dioxide by passing the air through canisters of potassium hydroxide, KOH.
The equation that best describes this reaction is
A. $KOH = K^+ + OH^-$
B. $CO_2 + H_2O = HCO_3^- + OH^-$
C. $H^+ + OH^- = H_2O$
D. $CO_2 + 2OH^- = CO_3^{2-} + H_2O$

Item 15

A flask contains 0.01 mole of helium at a temperature of 25^{o}C and a pressure of 5 x 10^{4} Pa. The volume of the flask measured in cm^{3} is

A. (0.01 x 8.31 x 5 x 10^{4})/298
B. (8.31 x 298)/5
C. (0.01 x 8.31 x 25 x 10^{6})/(5 x 10^{4})
D. (8.31 x 25)/(0.01 x 5 x 10^{4})

Item 16

The elements in Group II of the Periodic Table have

A. atoms with identical chemical properties.
B. atoms with identical physical properties.
C. atoms with the same electronic configuration.
D. atoms with 2 electrons in an 's' subshell.

Item 17

Which statement about E^{0} values is correct?

A. The stronger the reductant, the more negative the E^{0} value.
B. The stronger the reductant, the more positive the E^{0} value.
C. The stronger the reductant, the closer to zero the E^{0} value.

Item 18

Which one of the following best describes the corrosion of aluminium?

A. $Al^{3+}(aq) \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow Al^{2+}(aq)$
B. $Al(s) \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow Al^{3+}(aq)$
C. $Al(s) \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow Al^{2-}(aq)$
D. $Al^{3+}(aq) \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow Al(s)$

Item 19

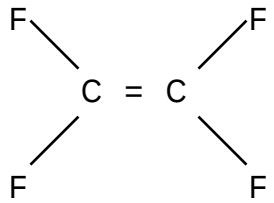
The elements in Group IV of the Periodic Table have

A. atoms with identical chemical properties.
B. atoms with 2 electrons in a p subshell.
D. atoms with identical physical properties.
C. atoms with the same electronic configuration.

Item 20
When benzene is burnt in excess oxygen, carbon dioxide and water vapour are formed. The volumes of carbon dioxide and water vapour (measured at the same temperature and pressure) would be in the ratio
A. 2 : 1
B. 1 : 2
C. 1 : 1
D. 4 : 1

Item 21
In an electrolytic cell, that is, a cell that uses energy to produce chemical reactions
A. an oxidation reaction occurs at the cathode and the anode is negative.
B. a reduction reaction occurs at the cathode and the anode is positive.
C. an oxidation reaction occurs at the cathode and the anode is positive.
D. a reduction reaction occurs at the cathode and the anode is negative.

Item 22
Polytetrafluoroethylene is formed from the monomer, tetrafluoroethylene,which has the structural formula



The empirical formula of polytetrafluoroethylene is
A. CF
B. C_2F
C. CF_2
D. C_2F_4

Item 23
Which one of the following lists contains only oxides which are acidic?
A. CO_2 , NO , SO_2
B. CO , P_4O_{10} , SO_3
C. CO_2 , NO , SO_3
D. SiO_2 , NO_2 , SO_2

Item 24
The compounds ethane and ethylene are similar in the fact that
A. they are both saturated molecules with the empirical formula CH_2.
B. they are both planar molecules with bond angles of approximately 120^o.
C. they are both hydrocarbons.
D. they are both unsaturated molecules that readily undergo addition reactions.

Item 25
The reaction between limestone and rainwater in the formation of a limestone cave is best shown by the equation
A. $Na_2CO_3(s) + H_2O(l) = Na_2CO_3(aq)$
B. $CaCO_3(s) + CO_2(aq) + H_2O(l) = Ca(HCO_3)_2(aq)$
C. $Na_2CO_3(aq) + 2H^+(aq) = 2Na^+(aq) + H_2O(l) + CO_2(g)$
D. $CaO(s) + H_2O(l) = Ca(OH)_2(aq)$

Item 26
Which one of the following is **NOT** part of the mixture called 'photochemical smog'?
A. nitrogen dioxide
B. peroxyacetyl nitrate (PAN)
C. oxygen
D. ozone

Item 27
In a volumetric analysis, the correct technique is essential for accurate results. The correct preparation of a burette for volumetric analysis is:
A. Rinse with distilled water.
B. Rinse with distilled water and dry thoroughly.
C. Dry thoroughly.
D. Rinse with the solution to be used.

Item 28
Diamond and graphite can both be described as giant molecules. The structures of these two materials are similar in that they both contain
A. carbon atoms with single covalent bonds only.
B. long chains of carbon atoms.
C. only carbon atoms with 6 neutrons.
D. carbon atoms arranged in 6-membered rings.

Item 29

In the production of nitric acid by the Ostwald Process, one of the steps involved is

$4NH_3(g) + 5O_2(g) = 4NO(g) + 6H_2O(g)$

Assuming complete reaction according to this equation, the mass of oxygen required to convert **1 tonne** of ammonia into products is

A. $(4 \times 10^6 \times 32)/(5 \times 17)$ g.

B. $(5 \times 10^6 \times 32)/(4 \times 17)$ g.

C. $(5 \times 17 \times 32)/(4 \times 10^6)$ g.

D. $(4 \times 10^6)/(5 \times 17 \times 32)$ g.

Item 30

The energy required to remove an electron completely from an atom is called the first ionisation energy. Which one of the following atoms would have the greatest first ionisation energy?

A. sodium

B. magnesium

C. silicon

D. aluminium

Item 31

In the helical structure of DNA, the nitrogen bases that are joined together by hydrogen bonding are respectively

A. adenine with guanine and thymine with cytosine.

B. adenine with cytosine and guanine with thymine.

C. adenine with thymine and guanine with cytosine.

D. adenine with adenine and thymine with cytosine.

Item 32

In which of the following pairs of molecules does sulfur show the oxidation numbers -2 and +6 respectively?

A. SO_2 and H_2SO_4

B. H_2SO_3 and H_2S

C. H_2S and Na_2S

D. H_2S and SO_3

Item 33

Of the elements whose atomic numbers are given below, which one has quite different properties from the others?

A. 12

B. 38

C. 20

D. 16

Item 34

0.5 mol of $Cu^{2+}(aq)$ and 1.0 mol of $Ag^{+}(aq)$ are contained in a beaker of water. What quantity of electricity would be required to deposit all of the copper and silver on the cathode of an electrolytic cell?

A. (1/3) x 96500 C
B. (1/2) x 96500 C
C. 2 x 96500 C
D. (3/2) x 96500 C

Item 35

Concentrated sulfuric acid, $H_2SO_4(l)$, can be used to produce

A. sodium chloride from hydrogen chloride.
B. oxygen from calcium oxide.
C. copper metal from copper(II) sulfate.
D. carbon from sugar.

Item 36

Metal R reacts with dilute HCl. Metal P will reduce solutions of both $RSO_4(aq)$ and $QSO_4(aq)$ to the respective metals R and Q.

A **POSSIBLE** order of standard electrode potentials (E^0) is (beginning with the most positive)

A. $H_2 > P > Q > R$
B. $P > Q > R > H_2$
C. $Q > H_2 > R > P$
D. $P > H_2 > R > Q$

Item 37

When concentrated aqueous ammonia is added to a precipitate of silver chloride, the precipitate dissolves to give a clear solution. One of the reactions which occurs is

$$Ag^{+}(aq) + 2NH_3(aq) = Ag(NH_3)_2^{+}(aq)$$

The addition of ammonia causes the silver chloride to dissolve because

A. silver chloride is more soluble in solutions of high pH.
B. hydrogen bonds are formed between the ammonia and the silver solution
C. NH_3 is extremely soluble in water.
D. $Ag^{+}(aq)$ is removed from the equilibrium $AgCl(s) = Ag^{+}(aq) + Cl^{-}(aq)$

Item 38

The chemical formula for urea is

A. $(NH_2)_2CO$
B. NH_2CO
C. $(CO)_2NH_2$
D. CONH

END OF SECTION A

SPECIFIC INSTRUCTIONS FOR SECTION B

(1) Section B consists of 10 questions, Questions 2 to 11, and is worth 72 marks and therefore about 65% of the total marks available for the examination. You should therefore spend about 2 hours on Section B. A suggested time allocation is given for each question and the marks allotted to each question are also indicated.

(2) Answers must be written in the spaces following each question in this booklet.

(3) You should show all working in numerical questions. No credit can be given for incorrect answers unless they are accompanied by details of the working.

(4) Full credit will **not** be given for unsimplified answers. When stating an answer, appropriate precision (number of significant figures) must be used and the units included.

(5) When chemical symbols are used in equations they must be accompanied by correct symbols of state, for example $H_2(g)$ for hydrogen gas.

QUESTION 2 (25 minutes, 15 marks)
The elements nitrogen, phosphorus and sulfur form oxides such as NO_2, P_4O_{10} and SO_3. Compare and contrast these three oxides (and any others) under the following headings:

(1) oxidation states of the elements in the oxides.
(2) preparation of the oxides.
(3) acidic properties of the oxides.

(An essay is **NOT** required. Credit will be given for all relevant factual information.)

QUESTION 2 (continued)

QUESTION 3 (10 minutes, 6 marks)
"The **main group** metals such as potassium and aluminium share some properties in common with **transition metals** such as iron and copper, but in other ways there are significant differences."
Discuss these similarities and differences.

QUESTION 4 (7 minutes, 5 marks)
Write the electronic configurations of the following atoms and ions:

(a) Mg^{2+} _____

(b) S^{2-} _____

(c) C _____

(d) N _____

(e) He _____

QUESTION 5 (10 minutes, 6 marks)
(a) Draw a sketch diagram of a cell suitable for the production of aluminum. Label your diagram carefully to show the cathode and anode, the products at each electrode and any special features of the cell.

(b) Write equations for each of the electrode reactions.

Cathode_____

Anode_____

QUESTION 6 (6 minutes, 4 marks)

A calorimeter is used to study the reaction between 100 cm^3 of 0.5M HCl(aq) and 100 cm^3 of 0.5M NaOH(aq).

If the calibration factor of the calorimeter and its contents is 160 $J/^oC$

and the calculated heat of reaction is -56.6 kJ mol^{-1}, what is the temperature rise during the reaction?

QUESTION 7 (14 minutes, 9 marks)
A useful galvanic cell for small articles such as watches makes use of silver oxide and zinc according to the equation (unbalanced)

$Zn(s) + Ag_2O(s) + H_2O(l) = Ag(s) + Zn^{2+}(aq) + OH^-(aq)$

The e.m.f. of the cell is 1.5V.

(a) Write the balanced equation for this reaction

_____

(b) Name the oxidant and the reductant in the cell.

Oxidant_____Reductant_____

(c) One of these galvanic cells delivers a continuous current of 0.10 mA for 200 days. Calculate the mass of Zn consumed during this time.

_____

_____

_____

_____

_____

_____

_____

(d) Describe how this cell could be recharged.

_____

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_____

QUESTION 8 (13 minutes, 8 marks)

HX is a weak acid which ionises slightly in aqueous solution according to the equation: $HX(aq) = H^+(aq) + X^-(aq)$

(a) Calculate the equilibrium constant for this equation at 25^{o}C if the equilibrium concentrations are:

$[HX] = 10^{-3}$ M , $[H^+] = [X^-] = 10^{-3.87}$ M

(b) NaX is added to this equilibrium mixture at 25^{o}C i.e. more X^- is added. Will the pH of the solution increase or decrease? Explain your answer.

(c) The temperature of the equilibrium mixture is altered. If the new equilibrium constant is $10^{-3.4}$M and $[HX] = 10^{-2.6}$M and $[X^-] = 10^{-3.7}$M, calculate the pH of the solution.

QUESTION 9 (10 minutes, 6 marks)
In the substances, (1) nitrogen, N_2 (2) oxygen, O_2 (3) hydrogen, H_2 and (4) silicon dioxide, SiO_2, COVALENT BONDING holds the atoms together.
However, in the element sodium, Na, the bonding is METALLIC.
Using these substances as examples, describe some of the similarities and differences between COVALENT BONDING and METALLIC BONDING.

QUESTION 10 (10 minutes, 6 marks)
Carbon can be oxidised by sulfuric acid according to the equation:

$$C(s) + 2H_2SO_4(l) = CO_2(g) + 2H_2O(l) + 2SO_2(g)$$

At a temperature 25^{o}C and 100,000 Pa pressure, calculate the **total** volume of gas produced when 100 cm^3 of 18M sulfuric acid is added to excess carbon.

QUESTION 11 (11 minutes, 7 marks)
"In the structures of both graphite and diamond, there are carbon atoms bonded to other carbon atoms."
Draw the structures of graphite and diamond and indicate their similarities and differences.

END OF 1990 CHEMISTRY YEAR 12 TRIAL EXAM

CHEMISTRY ASSOCIATES
P.O. BOX 2227
KEW, VIC., 3101
AUSTRALIA
TEL:(03) 9817 5374 FAX: (03) 9817 4334

SECTION A QUESTION 1 1B 2A 3C 4A 5A 6B 7D 8B 9A 10C 11A 12A 13B 14D 15B 16D 17A 18B 19B 20A 21B 22C 23D 24C 25B 26C 27D 28A 29B 30C 31C 32D 33D 34C 35D 36C 37D 38A

SECTION B

QUESTION 2

(a) oxidation states:
dinitrogen monoxide, N_2O (+1); nitrogen monoxide, NO (+2);
dinitrogen trioxide, N_2O_3 (+3); nitrogen dioxide, NO_2 (+4); dinitrogen tetroxide, N_2O_4 (+4);
dinitrogen pentoxide, N_2O_5 (+5); diphosphorus trioxide, P_2O_3 (+3); diphosphorus pentoxide, P_2O_5 (+5); sulfur dioxide,SO_2 (+4);
sulfur trioxide, SO_3 (+6).
(1) the highest oxidation state of each element = the number of outershell electrons.
(2) nitrogen shows the greatest range of oxidation states.

(b) preparation:
$NH_4NO_3 = N_2O + 2H_2O$;
$3Cu + 2NO_3^- + 8H^+ = 3Cu^{2+} + 2NO + 4H_2O$;
$2NO + O_2 = 2NO_2 = N_2O_4$; $P_4 + 3O_2 = P_4O_6$; $P_4 + 5O_2 = P_4O_{10}$;
$S + O_2 = SO_2$; $2SO_2 + O_2 = 2SO_3$
In the preparation of NO, 7M nitric acid is used. Equilibrium exists between NO_2 and N_2O_4 and also between SO_2 and SO_3.

(c) acidic properties:
N_2O and NO are neutral oxides but all of the others are acidic.
N_2O_3, N_2O_5, P_2O_3, P_2O_5, SO_2, SO_3 are the acid anhydrides of the corresponding acids, HNO_2, HNO_3, H_3PO_3, H_3PO_4, H_2SO_3, H_2SO_4.

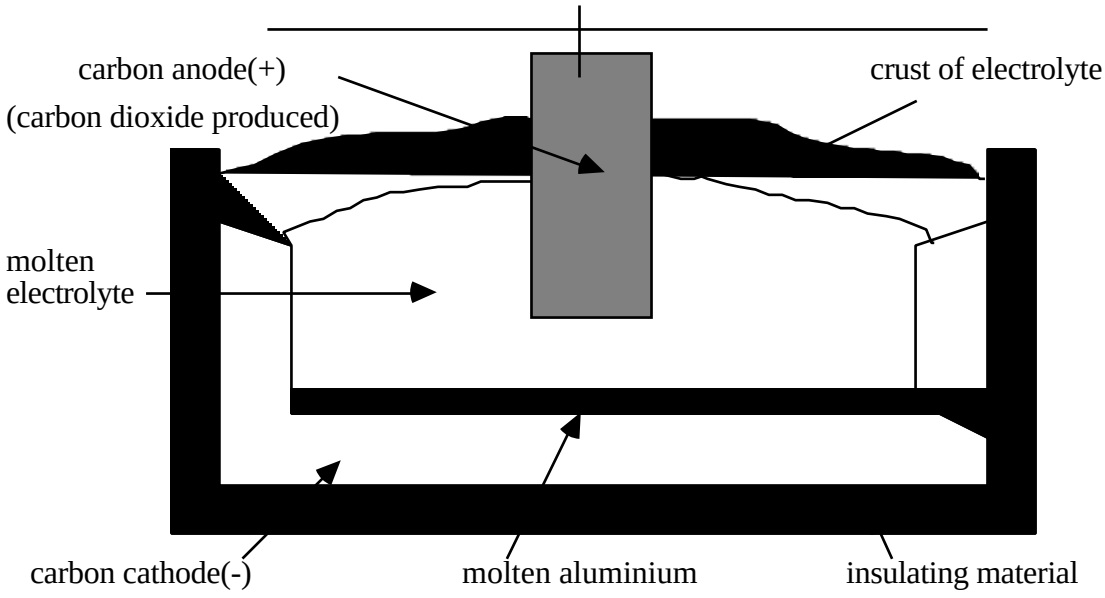
QUESTION 3
The common properties are caused by common metallic bonding-a network lattice of positive ions in a sea of mobile electrons.
(1) shiny; (2) malleable; (3) ductile; (4) good conductors of heat and electricity; (5) form positively charged ions.
The different properties are caused by differences in the crystal lattices.
(arrangement of the ions and electrons). (1) Fe, Cu have higher melting temperatures; (2) Fe, Cu have two oxidation states each; (3) Fe, Cu form coloured compounds; (4) Fe is readily magnetized;(5) K, Al are stronger reductants

QUESTION 4

(a) $1s^2 2s^2 2p^6$; (b) $1s^2 2s^2 2p^6 3s^2 3p^6$; (c) $1s^2 2s^2 2p^2$; (d) $1s^2 2s^2 2p^3$; (e) $1s^2$

QUESTION 5

(a)



(b) Cathode: $Al_2O_3(l) + 6e^- = 2Al(l) + 3O^{2-}$ Anode: $C(s) + 2O^{2-} = CO_2(g) + 4e^-$

QUESTION 6

The balanced equation is: $HCl(aq) + NaOH(aq) = NaCl(aq) + H_2O(l)$

n(HCl) = n(NaOH) = 0.5 x 0.1 = 0.05

heat evolved = K x ΔT and therefore, 56600 x 0.05 = 160 x ΔT

ΔT = (56600 x 0.05)/160 = 17.7^{o}C **ANS**

QUESTION 7

(a) $Zn(s) + Ag_2O(s) + H_2O(l) = 2Ag(s) + Zn^{2+}(aq) + 2OH^-(aq)$

(b) Oxidant is $Ag_2O(s)$ and reductant is Zn(s)

(c) $n(Zn) = (1/2) \times n(e^-) = (1/2) \times 0.1 \times 10^{-3} \times 200 \times 24 \times 3600/96500$

m(Zn) = n(Zn) x 65.4 = 0.59 g **ANS**

(d) Connect the cell to an **external power source.** The negative terminal must be linked to the zinc electrode and the positive terminal to the silver electrode.

QUESTION 8

(a) $K_C = [H^+]\ [H3OO^-] / [HCOOH]$

$= (10^{-3.87} \times 10^{-2.87})/10^{-3} = 10^{-4.74}$ **ANS**

(b) The addition of HX^- will shift the position of equilibrium to the left. More HX will be produced and H^+ will be used up. Hence, acidity will decrease. Hence, pH will increase.

(c) $[H^+] \times 10^{-3.7}/10^{-2.6} = 10^{-3.4}$

Hence, $[H^+] = (10^{-3.4} \times 10^{-2.6})/10^{-3.7} = 10^{-2.3}$M

Therefore, pH = 2.3 **ANS**

QUESTION 9

(1) Both types of bonding are fundamentally the same since they involve the attraction between positive and negative charges.

(2) Covalent bonding is the sharing of one or more electron pairs between atoms.
H_2 , discrete molecule, single covalent bonds; O_2 , discrete molecule, double covalent bond between the two oxygen atoms; N_2 , discrete molecule, triple covalent bond; SiO_2 , giant molecule, network lattice, single covalent bonds.

(3) Metallic bonding is the electrostatic force of attraction between positive ions and mobile electrons. The ions are arranged in a 3-dimensional network lattice.

(4) In covalent substances, the electrons are fixed within the bonds.Hence, they are non-conductors. In metals, the electrons are not tied to any particular ion. Hence, metals are conductors.

QUESTION 10

$n(H_2SO_4) = (2/3) \times n(gas)$.

Notice that both CO_2 and SO_2 are gases.

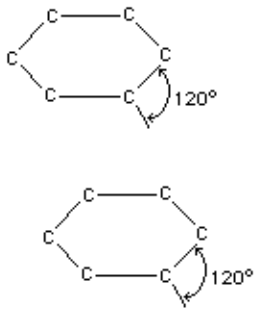
$\text{Vol} \times C = (2/3) \times PV/RT$

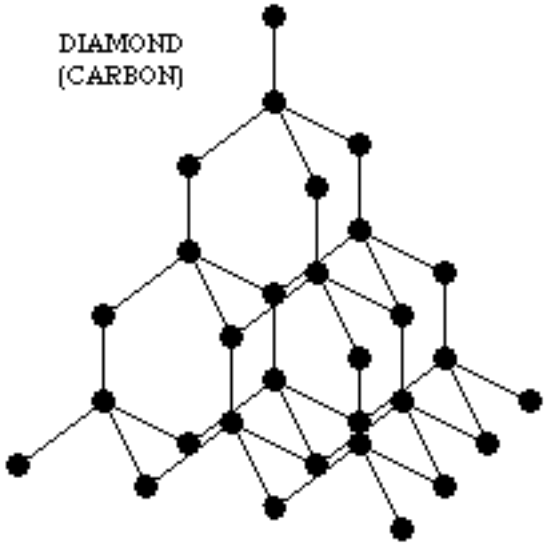
$0.1 \times 18 = (2/3) \times (10^5 \times V)/(8.31 \times 298)$

Hence, $V = 0.0669\ m^3 = 67\ dm^3$ **ANS**

QUESTION 11

Graphite is the element carbon. It has a layer lattice structure with strong covalent bonding within the layers and weak dispersion forces between the layers. Each carbon atom is bonded to three other carbon atoms in an hexagonal pattern within the plane. These planes of atoms can slide easily over each other. One electron per carbon is delocalised and can move within the plane when an electric field is applied.(A small section of each layer is shown below.)





Diamond has strong covalent bonding in three dimensions. There are four carbon atoms attached to each carbon atom.

END OF 1990 CHEMISTRY YEAR 12 TRIAL EXAM SOLUTIONS

CHEMISTRY ASSOCIATES
P.O. BOX 2227
KEW, VIC., 3101
AUSTRALIA
TEL:(03) 9817 5374 FAX: (03) 9817 4334