1995

CHEMISTRY

UNIT 2

TRIAL EXAM

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CHEMISTRY UNIT 2 (YEAR 11)
CHEMISTRY IN EVERYDAY LIFE

SECTION A. MULTIPLE CHOICE ANSWER SHEET

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ABSENT

SURNAME
GIVEN NAME(S)

How to complete this form

Please use an **HB PENCIL** only.
If you make a mistake, **ERASE** the incorrect answer.
DO NOT just cross it out.

EXAMPLE ONLY

9	**1**	**9**	**1**	**0**	**9**	**1**	**0**	**E**
0	0	0	0	0	0	0	0	A
1	1	1	1	1	1	1	1	E
9	9	9	9	9	9	9	9	X

Enter your Student Number (if one is provided) in the box below as shown in the example above

All answers must be completed like this.

A	B	C	D

ONLY mark ONE box per line.

STUDENT NUMBER

0	0	0	0	0	0	0	0	A
1	1	1	1	1	1	1	1	E
2	2	2	2	2	2	2	2	F
3	3	3	3	3	3	3	3	G
4	4	4	4	4	4	4	4	J
5	5	5	5	5	5	5	5	L
6	6	6	6	6	6	6	6	R
7	7	7	7	7	7	7	7	T
8	8	8	8	8	8	8	8	W
9	9	9	9	9	9	9	9	X

PLEASE TURN OVER

SECTION A.

MULTIPLE CHOICE ANSWER SHEET

Instructions

Complete **ALL** the questions.

Marks will **NOT** be deducted for incorrect answers.

NO mark will be given if more than **ONE** answer is completed for any question.

USE HB PENCIL ONLY.

One answer per line ***One answer per line*** ***One answer per line***

1	A	B	C	D	**11**	A	B	C	D	**21**	A	B	C	D
2	A	B	C	D	**12**	A	B	C	D	**22**	A	B	C	D
3	A	B	C	D	**13**	A	B	C	D	**23**	A	B	C	D
4	A	B	C	D	**14**	A	B	C	D	**24**	A	B	C	D
5	A	B	C	D	**15**	A	B	C	D	**25**	A	B	C	D
6	A	B	C	D	**16**	A	B	C	D	**26**	A	B	C	D
7	A	B	C	D	**17**	A	B	C	D	**27**	A	B	C	D
8	A	B	C	D	**18**	A	B	C	D	**28**	A	B	C	D
9	A	B	C	D	**19**	A	B	C	D	**29**	A	B	C	D
10	A	B	C	D	**20**	A	B	C	D	**30**	A	B	C	D

Please DO NOT fold, bend or staple this form

DETACH THIS ANSWER SHEET AT THE START OF THE EXAMINATION

CHEMISTRY UNIT 2 (YEAR 11)
CHEMISTRY IN EVERYDAY LIFE
1995 TRIAL EXAMINATION

(not to be used before Monday October 2, 1995)

Reading time: 15 minutes

Total writing time: 1 hour 30 minutes

STUDENT NAME _____

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

Directions to students

Materials

Question and answer booklet of 18 pages.
A data sheet which should be removed at the beginning of the examination
Multiple choice answer sheet.
An approved calculator may be used.

The task

Answer all items from Section A.
Section A items should be answered on the multiple-choice answer sheet provided.
Answer all questions from Section B.
Section B questions should be answered in this booklet in the spaces provided following each question.
All written responses should be in English.

At the end of the task

Please ensure that you write your **name** in the space provided on this booklet and your **name and student number (if one is provided)** in the space provided on the multiple-choice answer sheet.
Place the multiple-choice answer sheet inside the back cover of this booklet and hand them in.

SPECIFIC INSTRUCTIONS FOR SECTION A

(1) Section A, Question 1, consists of 30 multiple choice items and is worth 30 marks and therefore 30% of the total marks available for this examination. You should therefore spend about 27 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.

DATA

TABLE 1: RELATIVE ATOMIC MASS

Element	*Symbol*	*Relative Atomic Mass*
Calcium	Ca	40.1
Carbon	C	12.0
Chlorine	Cl	35.5
Hydrogen	H	1.0
Oxygen	O	16.0
Phosphorus	P	31.0
Sodium	Na	23.0

TABLE 2: PHYSICAL CONSTANTS

Avogadro constant (N_A)	6.023×10^{23} mol^{-1}
Ideal gas molar volume at STP	(0^oC and 1 atmosphere pressure)
	(273K and 101325 Nm^{-2} (Pa)) = 22.4 L
Universal gas constant (R)	8.31 J K^{-1} mol^{-1}

SECTION A QUESTION 1

For each of the following , put a line through the correct response on the answer sheet provided.

Item 1

Which one of the following contains an acid and a base **in that order**?

A. lemon juice, vinegar

B. sodium bicarbonate, lemon juice

C. vinegar, sodium carbonate

D. sodium carbonate, sodium bicarbonate

Item 2

Formic acid (HCOOH) is known as an acid because it

A. produces OH^- ions in aqueous solution.

B. produces H_3O^+ ions in aqueous solution.

C. reacts with sodium chloride to produce H_2 gas.

D. neutralises hydrochloric acid.

Item 3

The conjugate base of the bicarbonate ion, HCO_3^- is

A. H_2CO_3

B. H_2O

C. OH^-

D. CO_3^{2-}

SECTION A QUESTION 1

Item 4
Which one of the following contains acids listed in order from **strongest** to **weakest**?

A. HCl , HSO_4^- , CH_3COOH , H_2O

B. HSO_4^- , HCl , CH_3COOH , H_2O

C. CH_3COOH , HCl , HSO_4^- , H_2O

D. H_2O , CH_3COOH , HSO_4^- , HCl

Item 5
Of the following solutions, which one contains the **smallest** concentration of $H_3O^+(aq)$ ions?

A. pH = 1

B. pH = 4

C. pH = 7

D. pH = 10

Item 6
In one mole of aluminium hydroxide, $Al(OH)_3.3H_2O$, there is

A. 3 mole of aluminium atoms.

B. 5 mole of hydrogen atoms.

C. 16 mole of atoms.

D. 4 mole of oxygen atoms.

SECTION A QUESTION 1

Item 7
In exactly 2.0 g of hydrogen gas, H_2, there are approximately

A. 6.023×10^{23} hydrogen molecules.

B. 1.2×10^{24} hydrogen molecules.

C. 6.023×10^{23} hydrogen atoms.

D. 6.023×10^{23} protons.

Item 8
The pH of 100 mL of a 0.1 mol dm^{-3} solution of HCl is

A. 1

B. 2

C. 3

D. 4

Item 9
The relative formula mass of calcium hydrogen carbonate, $Ca(HCO_3)_2$ is closest to

A. 149.1

B. 161.1

C. 162.1

D. 202.2

Item 10
Which one of the following is **not** an empirical formula?

A. CH_2O

B. C_2H_3O

C. $C_8H_9O_5$

D. $(COOH)_2$

SECTION A QUESTION 1

Item 11
Which one of the following chemical equations best summarises the process of cell respiration?

A. $6CO_2(g) + 6H_2O(l) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$

B. $C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$

C. $C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(aq) + 2CO_2(g)$

D. $2C_6H_{12}O_6(aq) \rightarrow C_{12}H_{22}O_{11}(aq) + H_2O(l)$

Item 12
Nitrogen fixation is best described as

A. the direct absorption of atmospheric nitrogen by plants.

B. the conversion of atmospheric nitrogen into nitrites and nitrates.

C. the conversion of nitrites and nitrates into atmospheric nitrogen.

D. the release of nitrogen gas into the atmosphere.

Item 13
Which one of the following chemical equations best describes the reaction occurring in an internal combustion engine?

A. $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$

B. $C_7H_{16}(l) + 11O_2(g) \rightarrow 7CO_2(g) + 8H_2O(l)$

C. $C_7H_{14}(g) + \frac{21}{2} O_2(g) \rightarrow 7CO_2(g) + 7H_2O(l)$

D. $C_{11}H_{24}(l) + 17O_2(g) \rightarrow 11CO_2(g) + 12H_2O(l)$

Item 14
Which one of the following gases is **least** likely to be considered an atmospheric pollutant?

A. H_2

B. CO_2

C. CH_4

D. O_3

Item 15
Nitrogen gas is produced commercially by

A. filtration from the air.

B. heating of nitrogen-containing compounds.

C. fractional distillation of liquid air.

D. decomposition of liquid ammonia (NH_3).

Item 16
Of the following gases, which one has the **lowest** boiling temperature?

A. N_2

B. O_2

C. CO_2

D. Ar

Item 17
The atoms of the noble gases He, Ne , Ar , Kr and Xe have

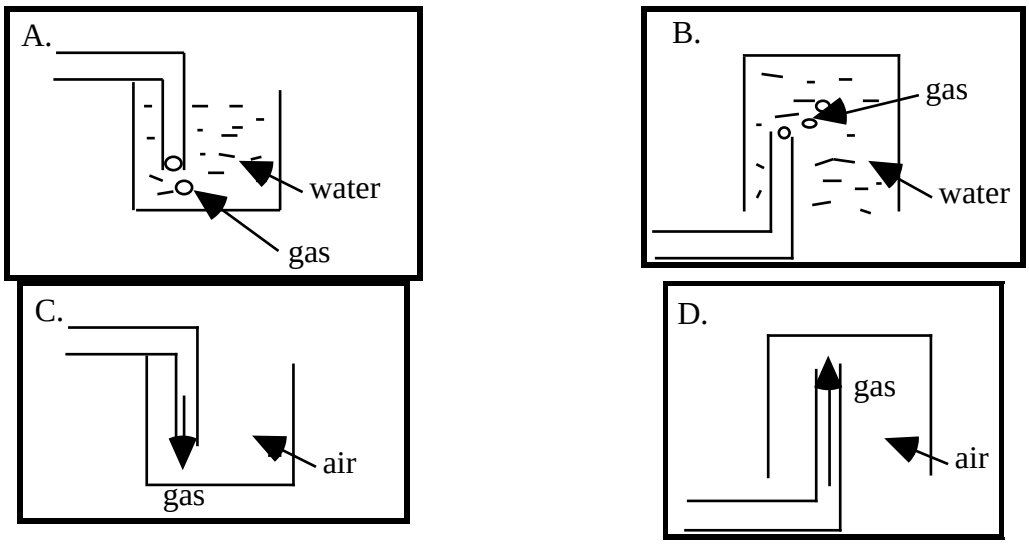
A. either 2 or 8 electrons in their outershells.

B. 2 electrons in their outershells.

C. 8 electrons in their outershells.

D. varying numbers of electrons in their outershells.

Questions 18 and 19 refer to the following diagrams which illustrate methods of collecting gases from chemical reactions in the laboratory.



Item 18
Which one of these methods is **best** for collecting a sample of carbon dioxide gas in a laboratory preparation?

A. **A**

B. **B**

C. **C**

D. **D**

Item 19
Which one of these methods is **best** for collecting a sample of oxygen gas in a laboratory preparation?

A. **A**

B. **B**

C. **C**

D. **D**

SECTION A QUESTION 1

Item 20
Which one of the following is best in agreement with the Kinetic Molecular Theory of Matter?

A. The particles in gases only are in constant motion when the temperature is greater than zero Kelvin.

B. The particles in gases and liquids only are in constant motion when the temperature is greater than zero Kelvin.

C. The particles in gases, liquids and solids are in constant motion only when the temperature is greater than zero degrees Celsius.

D. The particles in gases, liquids and solids are in constant motion when the temperature is greater than zero Kelvin.

Item 21
A precise chemical word that describes the **corrosion** of metals is

A. reduction

B. oxidation

C. catalysis

D. neutralisation

Item 22
Which one of the following metals does **not** corrode in the atmosphere?

A. zinc

B. iron

C. copper

D. gold

Item 23
Which one of the following chemical equations best illustrates the corrosion of aluminium metal?

A. $Al(s) + O_2(g) \rightarrow AlO_2(s)$

B. $2Al(s) + O_2(g) \rightarrow 2AlO(s)$

C. $3Al(s) + O_2(g) \rightarrow Al_3O_2(s)$

D. $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$

Item 24

In the reaction, $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$, the reductant is

A. Zn

B. Cu in $CuSO_4(aq)$

C. S in $CuSO_4(aq)$

D. O in $CuSO_4(aq)$

Item 25

In a reduction reaction at an electrode,

A. one or more electrons are lost.

B. one or more electrons are gained

C. one or more protons are lost.

D. one or more protons are gained.

Item 26

In a galvanic cell, the electrode at which oxidation occurs is

A. negative and is called the cathode.

B. positive and is called the anode.

C. negative and is called the anode.

D. positive and is called the cathode.

Item 27

In a galvanic cell, electrons always flow

A. from the cathode to the anode.

B. through the salt bridge towards the anode.

C. through the salt bridge towards the cathode.

D. from the anode to the cathode.

SECTION A QUESTION 1

Item 28
In a galvanic cell, anions always flow through

A. the wire in the external circuit from the anode to the cathode.

B. the wire in the external circuit from the cathode to the anode

C. the salt bridge towards the anode.

D. the salt bridge away from the anode.

Item 29
Under certain conditions, iron will rust in the atmosphere. Which one of the following equations **best** illustrates the formation of rust from metallic iron?

A. $2Fe(s) + O_2(g) \rightarrow 2FeO(s)$

B. $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

C. $3Fe(s) + 2O_2(g) \rightarrow Fe_3O_4(s)$

D. $4Fe(s) + 3O_2(g) + 2xH_2O(l) \rightarrow 2Fe_2O_3.xH_2O(s)$

Item 30
Which one of the following methods could be used to minimise the corrosion of an iron pipe buried in moist soil?

A. Attach a piece of copper metal to the iron pipe.

B. Attach the iron pipe to the negative terminal of a battery.

C. Supply the iron pipe with a positive potential.

D. Use a chemical to remove the moisture from the soil.

END OF SECTION A

SECTION B

SPECIFIC INSTRUCTIONS FOR SECTION B

(1) Section B consists of 8 questions (numbered 2 to 9) and is worth 70 marks and therefore 70% of the total marks available for the examination.

You should therefore spend about 63 minutes on Section B.
The marks allotted to each question are indicated.

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

(3) 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 (7 minutes, 2+2+2+2 = 8 marks)

Write a balanced chemical equation for each of the following:

(a) aqueous sulfuric acid reacts with solid sodium carbonate.

_____

(b) aqueous hydrochloric acid reacts with aqueous sodium hydrogen carbonate.

_____

(c) solid aluminium oxide reacts with dilute nitric acid.

_____

(d) acetic acid is neutralised by aqueous sodium hydroxide.

_____

QUESTION 3 (8 minutes, 4+4 = 8 marks)

(a) In the data table, the relative atomic mass of carbon is given as 12.0. Explain the meaning of relative atomic mass and show clearly how it is different from relative isotopic mass.

(b) Calculate the percentage composition of carbon in carbonic acid (H_2CO_3).

QUESTION 4 (8 minutes, 4 + 5= 9 marks)

(a) When carbon dioxide is bubbled into an aqueous solution of calcium hydroxide, a white precipitate is formed. This white precipitate disappears and a clear solution results when more carbon dioxide is bubbled into the solution.

Write balanced equations for these two reactions.

_____

_____

(b) Calculate the maximum mass of calcium sulfate that could be produced from the reaction between 100 mL of 0.1 mol dm^{-3} H_2SO_4 and 100 mL of 0.05 mol dm^{-3} $Ca(OH)_2$.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

QUESTION 5 (8 minutes, 2+2+2+3 = 9 marks)

(a) (i) Write a balanced chemical equation for the preparation of oxygen gas from hydrogen peroxide.

_____

(ii) Describe a test that would show the presence of oxygen gas in your collected sample.

_____
_____
_____
_____
_____

(b) (i) Write a balanced chemical equation for the preparation of carbon dioxide gas from calcium carbonate.

_____

(ii) Describe **two** tests that would show the presence of carbon dioxide gas in your collected sample and would show that the gas is **not** nitrogen

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

QUESTION 6 (8 minutes, 2+3+4 = 9 marks)

Helium gas is the first member of the noble gas group.

(a) Give two uses for the gas helium.

(b) 1L of pure helium is collected at $0^{o}C$ and constant pressure. What would be the volume of the helium sample at the same pressure and a temperature of $273^{o}C$?

(c) Calculate the mass of helium in the sample if the pressure is 10^{5} Nm^{-2} (Pa).

QUESTION 7 (8 minutes, 2+3+4 = 9 marks)
Carbon monoxide gas will react with oxygen gas to produce carbon dioxide gas. In a particular experiment 56 g of carbon monoxide reacts with excess oxygen to produce carbon dioxide.

(a) Write a balanced equation for this reaction.

_____

(b) Calculate the mass of oxygen used in the reaction.

_____
_____
_____
_____
_____

(c) Calculate the volume of carbon dioxide produced at STP.

_____
_____
_____
_____
_____

QUESTION 8 (8 minutes, 1+1+1+2+2+2 = 9 marks)

(a) For each of the following four experiments, complete the balanced equation if you would expect a reaction to occur. If you would not expect a reaction, write **NO REACTION**.

(i) $Zn(s) + Ag^{+}(aq) \rightarrow$

_____

(ii) $Mg^{2+}(aq) + Cu(s) \rightarrow$

_____

(iii) $Fe(s) + Cu^{2+}(aq) \rightarrow$

_____

(iv) $Na(s) + Mg^{2+}(aq) \rightarrow$

_____

(b) Identify two reductants in the reactions above.

_____

(c) Write the names of the metals in part (a) in order from **most** active to **least** active.

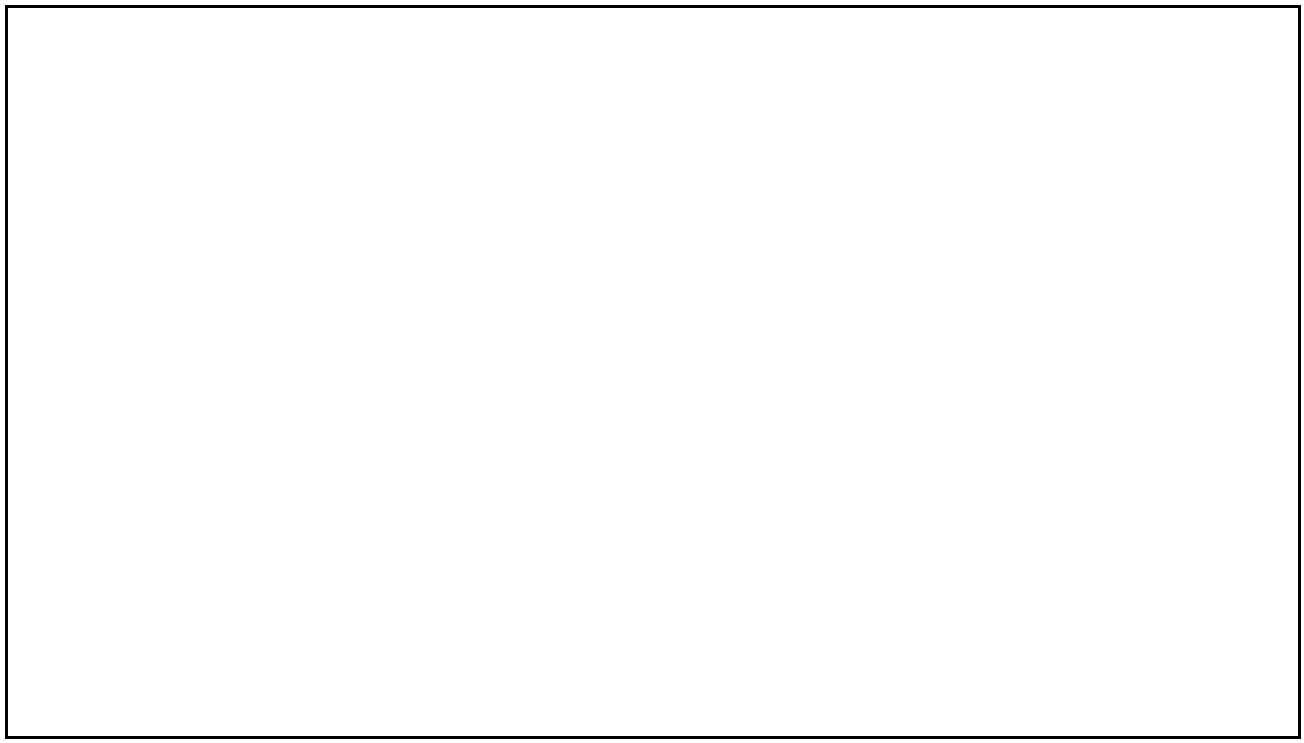
_____

_____

QUESTION 9 (8 minutes, 7+1+1 = 9 marks)

(a) For the reaction between Zn(s) and Ag^+(aq), draw a fully labelled galvanic cell, showing clearly

(i) anode
(ii) positive electrode
(iii) contents of the Ag^+(aq) half-cell
(iv) contents of the Zn(s) half-cell
(v) direction of electron flow
(vi) direction of ion flow
(vii) contents of the salt bridge



(b) Write the equation for the reaction occurring at the anode.

_____

(c) Write the equation for the reaction occurring at the cathode.

_____

END OF QUESTION AND ANSWER BOOKLET

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SUGGESTED SOLUTIONS

QUESTION 1

ITEM 1 ANS C
Vinegar and lemon juice are acids (acetic acid and citric acid respectively) while sodium carbonate and sodium bicarbonate are bases.

ITEM 2 ANS B

Formic acid produces $H_3O^+(aq)$ ions in aqueous solution according to the equation:

$HCOOH(aq) + H_2O(l) \rightarrow H_3O^+(aq) + HCOO^-(aq)$

ITEM 3 ANS D

To obtain the conjugate base of an acid, take H^+ out of the formula.
Hence, CO_3^{2-} is the conjugate base of HCO_3^-.

ITEM 4 ANS A
A strong acid is completely ionised in solution. A weak acid is only partially ionised in solution. The order from strongest acid to weakest acid is HCl , HSO_4^- , CH_3COOH , H_2O.

ITEM 5 ANS D

Since $pH = -\log_{10}[H_3O^+]$, the higher the pH, the smaller the hydrogen ion concentration.
At pH = 10, $[H_3O^+] = 10^{-10}$ mol dm^{-3}.

ITEM 6 ANS C
The total number of mole of atoms = 1Al + 6O + 9H = 16 mole of atoms.

ITEM 7 ANS A

$n(H_2) = \frac{2.0}{2.0} = 1$. Hence, approximate number of hydrogen molecules = $1 \times 6.023 \times 10^{23}$.

ITEM 8 ANS A

$[H_3O^+] = [HCl] = 0.1\ M = 10^{-1}\ M$. Hence, pH = 1

ITEM 9 ANS C
Relative formula mass = 40.1 + 2 x (1 + 12 + 48) = 40.1 + (2 x 61) = 40.1 + 122 = 162.1

ITEM 10 ANS D
An empirical formula is the simplest whole number ratio of atoms in a formula. $(COOH)_2$ is **not** an empirical formula. The empirical formula would be CO_2H.

ITEM 11 ANS B
Cell respiration involves the reaction of oxygen with glucose to produce carbon dioxide and water.

SUGGESTED SOLUTIONS

ITEM 12 ANS B
Nitrogen fixation involves the conversion of atmospheric nitrogen (N_2) into useable soluble forms such as nitrites (NO_2^-) and nitrates (NO_3^-)

ITEM 13 ANS B
Petrol consists mainly of the alkane heptane, C_7H_{16}. In the internal combustion engine, heptane reacts with oxygen in the air to form carbon dioxide and water.

ITEM 14 ANS A
CO_2 and CH_4 contribute to global warming. O_3 is an irritant to the respiratory tract. H_2 is a small molecule which reacts readily with oxygen to produce water.

ITEM 15 ANS C
Air is a mixture of gases (mainly N_2 and O_2). Air is turned into a liquid and then heated slowly. N_2 is collected at its boiling temperature of -196^oC and O_2 is collected at its boiling temperature of -183^oC. This is known as fractional distillation.

ITEM 16 ANS A
The boiling temperatures of these gases are:
N_2 -196^oC ; O_2 -183^oC ; CO_2 -79^oC ; Ar -186^oC ;

ITEM 17 ANS A
Helium has two electrons in its outershell. All of the other noble gases have eight electrons in their outershells.

ITEM 18 ANS C
Carbon dioxide gas is soluble in water and denser than air. Hence, it is best collected by upward displacement of air in a gas jar.

ITEM 19 ANS B
Oxygen gas is only slightly soluble in water and is approximately the same density as air. Hence, it is best collected by downward displacement of water in a gas jar.

ITEM 20 ANS D
According to the Kinetic Molecular Theory, the particles in solids, liquids and gases are in constant motion at any temperature above absolute zero (0 Kelvin)

ITEM 21 ANS B
Corrosion involves the loss of electrons from a metal. Loss of electrons is called oxidation.

ITEM 22 ANS D
Gold will not corrode in the atmosphere. Very severe conditions are required to oxidise gold.

ITEM 23 ANS D
When aluminium metal corrodes, it forms aluminium in the +3 oxidation state, as in the formula Al_2O_3

SUGGESTED SOLUTIONS

ITEM 24 ANS A

The reductant is the element that loses electron(s). In this case, Zn(s) changes into Zn^{2+}(aq) by losing two electrons.

ITEM 25 ANS B

Reduction involves the gain of one or more electrons.

ITEM 26 ANS C

Oxidation occurs at the anode. The loss of electrons at the anode makes the anode negative.

ITEM 27 ANS D

Because the anode is negative, electrons will flow from the anode to the cathode.

ITEM 28 ANS C

Anions are negatively charged. Hence, anions will flow in the same direction in the circuit as the negatively charged electrons.

ITEM 29 ANS D

The formation of rust involves the reaction of metallic iron with oxygen and water. The actual water composition of the rust is variable.

ITEM 30 ANS B

To minimise the corrosion of an iron pipe, it is necessary to prevent the electrons being lost by the iron. To do this, a flow of electrons can be forced towards the iron by connecting the negative terminal of a battery to the iron.

SECTION B

QUESTION 2

(a) $H_2SO_4(aq) + CaCO_3(s) \rightarrow CaSO_4(s) + H_2O(l) + CO_2(g)$

(b) $HCl(aq) + NaHCO_3(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$

(c) $Al_2O_3(s) + 6HNO_3(aq) \rightarrow 2Al(NO_3)_3(aq) + 3H_2O(l)$

(d) $CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(l)$

QUESTION 3

(a) The relative isotopic mass is the mass of an isotope relative to $^{12}C_6$ which is taken as exactly 12. $^{12}C_6$ is the reference point. Naturally occurring carbon is a mixture of isotopes with different relative isotopic masses and different abundances. The relative atomic mass of carbon is a weighted average of these relative isotopic masses. Hence, it is not exactly 12. To two decimal places it is 12.01

(b) Percentage of carbon in $H_2CO_3 = \frac{12.0}{(2 + 12.0 + 48)} \times 100 = \frac{12}{62} \times 100 = 19.4\ \%$ **ANS**

SUGGESTED SOLUTIONS

QUESTION 4

(a) $Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$ white precipitate

then

$CaCO_3(s) + CO_2(g) + H_2O(l) \rightarrow Ca(HCO_3)_2(aq)$ clear solution

(b) The balanced equation is: $Ca(OH)_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2H_2O(l)$
$n(H_2SO_4) = 0.1 \times 0.1 = 0.01$ and $n(Ca(OH)_2) = 0.1 \times 0.05 = 0.005$
From the balanced equation, $n(CaSO_4)$ formed = $n(Ca(OH)_2)$ used up = 0.005
Hence, $m(CaSO_4)$ formed = $n \times M_r$ $= 0.005 \times (40.1 + 32.1 + 64)$
$= 0.005 \times 136.2 = 0.681$ g **ANS**

QUESTION 5

(a) (i) $2H_2O_2(aq) \xrightarrow{MnO_2 \text{ catalyst}} 2H_2O(l) + O_2(g)$

(ii) Oxygen gas will relight a glowing splint.

(b) (i) $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

(ii) Carbon dioxide gas will extinguish a flame (as will nitrogen) and will form a slightly acidic solution in water (nitrogen will not). The reaction with $Ca(OH)_2(aq)$ from **QUESTION 4** will also identify carbon dioxide.

QUESTION 6

(a) Helium can be used to fill lighter-than-air balloons and to provide an inert atmosphere for chemical reactions.

(b) At constant pressure, $\frac{V_1}{T_1} = \frac{V_2}{T_2}$. Hence, $\frac{V_2}{(273+273)} = \frac{1}{273}$ $V_2 = 1 \times \frac{546}{273} = 2$ L **ANS**

(c) $n(He) = \frac{PV}{RT} = \frac{10^5 \times 1 \times 10^{-3}}{8.31 \times 273}$ $m(He) = \frac{10^5 \times 1 \times 10^{-3}}{8.31 \times 273} \times 4$

$= 0.18$ g (0.176 g) **ANS**

QUESTION 7

(a) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

(b) $n(O_2)$ used $= \frac{1}{2} \times n(CO) = \frac{1}{2} \times \frac{56}{28} = 1.$
Hence, $m(O_2) = 1 \times 32 = 32$ g **ANS**

(c) $n(CO_2)$ produced = $n(CO)$ used up $= \frac{56}{28} = 2.0$ mol.
Hence, $V(CO_2)$ at STP $= 2.0 \times 22.4$ L $= 44.8$ L (dm^3) **ANS**

SUGGESTED SOLUTIONS

QUESTION 8

(a) (i) $Zn(s) + 2Ag^{+}(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$

(ii) NO REACTION

(iii) $Fe(s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu(s)$

(iv) The sodium metal will react with the water!

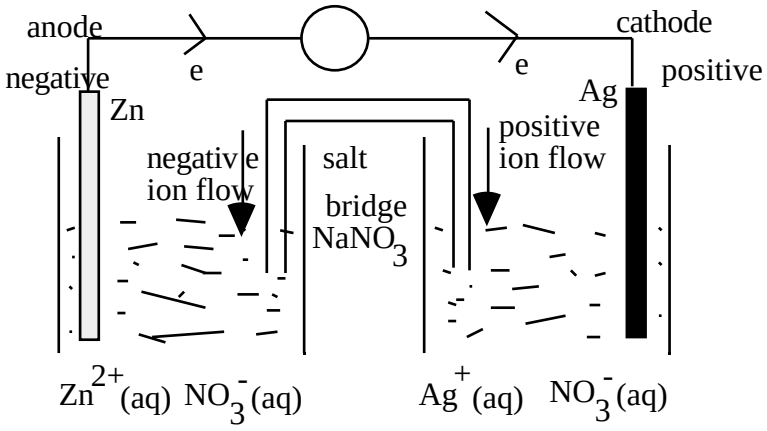
$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

(b) The reductants are Zn(s) , Fe(s) and Na(s) (any two)

(c) **most active** Na , Mg , Zn , Fe , Cu , Ag **least active**

QUESTION 9

(a)



(b) Anode: $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^{-}$

(c) Cathode: $Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$

END OF SUGGESTED SOLUTIONS

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