ADELAIDE HIGH SCHOOL

MID-YEAR EXAMINATION, 2002

Time : 1 Hour 30 Minutes
+ 10 minutes reading time

STAGE 1 CHEMISTRY

This examination consists of four questions

All questions are to be answered in this booklet

Question	Total Marks	Marks Obtained
1	27	
2	31	
3	27	
4	35	
TOTAL	120	

Name : _____ **Class** _____

Subject Teacher : _____

Question 1

(a) The table below gives some information about melting points, boiling points and electrical conductivity of a number of substances.

Substance	Melting Point (°C)	Boiling Point (°C)	Electrical Conductivity	
			Solid	Molten
lithium bromide	550	1265	low	high
nitrogen fluoride	-207	-129	low	low
rhodium	1970	3730	high	high
silicon dioxide	1700	2230	low	low
strontium fluoride	1400	2480	low	high
toluene	-95	111	low	low

From the above list

(1) Which substance is a gas at room temperature? _____ [1]

(2) Name a substance that is covalent molecular _____ [1]

(3) Name a substance that is ionic. _____ [1]

(4) Name a substance that is a covalent network. _____ [1]

(5) Name a substance with metallic bonding. _____ [1]

(b) Aluminium is widely used as a building material in fixtures like window frames and sliding doors. It can be shaped into frames using heavy duty machines because it is malleable.

(1) Write the electronic configuration for an aluminium atom. _____ [1]

(2) Explain in terms of the metallic bonding model and with the aid of a labelled diagram why aluminium is malleable.

_____

_____

_____

_____ **Diagram**

[4]

(c) Saucepans and frying pans are sometimes made from aluminium. Suggest two properties apart from malleability that make aluminium suitable for this use.

_____

_____

[2]

(d) Aluminium is sometimes mixed with magnesium to produce magnalium, which is used in light weight optical instruments.

(1) What name is given to a mixture of metals like magnalium? _____ [1]

(2) How would magnalium be made? _____

_____ [1]

(e) Aluminium oxide (Al_2O_3) is an ionic compound. It is a black powder with a melting point above1000˚C. It will not conduct electricity until it is melted. Outline the bonding in aluminium oxide and use it to explain why it has a high melting point and will only conduct electricity in the molten state.

_____

_____

_____

_____

_____

_____

_____ [5]

(f) Write the electronic configuration of the aluminium **ion** _____ [1]

(g) Write formulae for the following ionic compounds:

(1) calcium chloride _____ (2) potassium carbonate_____ [2]

(g) **Briefly** outline the structure of graphite and so explain why it is a good conductor of electricity and a good lubricant. The diagram below may help you.

_____

_____

_____

_____

_____

_____

_____ [5]

Total marks 27

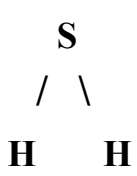
Question 2

(a) Consider the molecules shown below:

A **O = C = O**

B **N ≡ N**

C



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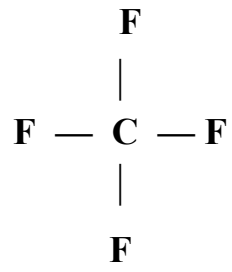

(1) Which of the above is a diatomic molecule? _____
[1]

(2) Which contains a triple covalent bond? _____
[1]

(3) Which of the above molecules does **not** contain polar bonds? _____
[1]

(4) Which of the above molecules is a polar molecule? Give reasons for your answer.

_____

_____

_____

_____
[3]

(b) Draw the structures of the following molecules showing lone pairs of elctrons around the central atom. Then state the shape of each molecule.

MOLECULE	water H_2O	methane CH_4	sulfur trioxide SO_3	hydrogen cyanide HCN
Structure				
Shape				

[8]

(c) (1) Draw the structure of an ammonia (NH_3) molecule, showing lone pairs of electrons.

[1]

(2) Explain **why** the shape of an ammonia molecule is a trigonal pyramid.

_____

_____

_____

_____

_____

[3]

(d) Consider the atoms listed :

$^{40}_{19}A$ $^{40}_{20}B$ $^{41}_{19}C$ $^{40}_{18}D$

(1) What is the atomic number of A? _____

[1]

(2) What is the mass number of A? _____

[1]

(3) How many protons has A? _____

[1]

(4) How many electrons has A? _____

[1]

(5) Write the electronic configuration for A _____

[1]

(6) In which group of the Periodic table is A? _____

[1]

(7) In which period of the Periodic table is A? _____

[1]

(8) How many neutrons has A _____

[1]

(9) Name the element that atom A represents. _____

[1]

(10) Is A a solid, liquid or gas? _____

[1]

(11) Is A a metal or non-metal? _____

[1]

(12) Does A have a high or low electronegativity? _____

[1]

(13) Which of atoms A to D are isotopes? _____

[1]

Total marks 31

Question 3

(a) Pure nitric acid (HNO_3) is a poor conductor of electricity whereas a dilute aqueous solution of nitric acid is a good conductor of electricity.

(1) Explain this difference in electrical conductivity.

_____

_____

[2]

(2) Write an equation for the reaction between nitric acid and water.

_____

[2]

(3) What name is given to a reaction of this type? _____

[1]

(b) Write equations for the reactions that occur when the following compounds dissolve in water.

(1) Ammonia (NH_3)

_____

[2]

(2) Sodium sulfate (Na_2SO_4)

_____

[2]

(c) Classify the following salts as soluble or insoluble.

(1) copper hydroxide _____

(2) ammonium carbonate _____

[2]

(d) Name the precipitate that would form when the following pairs of solutions are mixed.

(1) potassium sulfate and barium nitrate _____

(2) zinc sulfate and sodium hydroxide _____

[2]

(e) Suggest **two** solutions that you could mix together to make a precipitate of copper carbonate.

_____

_____

[2]

(f) Write formulae for the following ionic compounds.

(1) sodium oxide _____

(2) calcium hydrogencarbonate _____

[2]

(g) (1) Write an equation for the reaction between silver nitrate solution and calcium chloride solution.

_____

[2]

(2) Write an **ionic** equation for the reaction between lead nitrate solution and copper sulfate solution.

_____

[2]

(h) Three unknown solutions A, B, and C are all sodium compounds. They were tested with silver nitrate solution, barium chloride solution and dilute nitric acid. The results are shown below.

	A	B	C
Silver nitrate solution	No observed change	White precipitate	White precipitate
Barium chloride solution	No observed change	No observed change	White precipitate
Dilute nitric acid	No observed change	No observed change	Bubbles form

(1) Identify the negative ions in A, B and C.

A _____

B _____

C _____

[3]

(2) Name the gas that causes the bubbles in the reaction between C and nitric acid.

_____

[2]

(i) Balance the following equations.

(1) $CS_2 + Cl_2 \longrightarrow CCl_4 + S$

(2) $CuS + O_2 \longrightarrow CuO + SO_2$

[2]

Total 28 marks

Question 4

(a) Give systematic names for the following organic molecules **:**

(1) $CH_3 - CH(CH) - CH(CH_3) - CH_2 - CH_3$

_____

(2) $CH_3 - CH_2 - C(CH_3) = CH_2$

_____

(3) $CH_3 - C(CH_3)(CH_3) - C \equiv C - CH_3$

_____

[3]

(b) Draw structures for the following molecules:

(1) 3-methylpent-2-ene

(2) propanoic acid

[2]

(c) Ethane and ethene were both mixed with bromine water, but they reacted at much different rates. The reactions were carried out in a well-lit room on a warm day.

Complete the following table that relates to the above reactions.

	ethane	ethene
Would you expect the reaction to be fast or slow?		
Draw the structure of any new organic products formed.		
What name is given to this type of reaction?		

[6]

(d) Describe the colour change that occurs when bromine water reacts with the above hydrocarbons.

_____

[2]

(e) Ethanol (C_2H_5OH) is a member of the alcohol series. It is extremely soluble in water.

(1) Explain why it is so soluble in water.

_____

_____

_____

_____

_____

[3]

(f) Ethanol can be made by fermentation of glucose. Writ e a balanced equation for this reaction.

_____

[2]

(g) Ethanol will burn in air with a clear blue flame. Write a balanced equation for the combustion of ethanol.

_____

[2]

(h) Butan-1-ol can be tested by reacting it with acidified potassium dichromate solution. It forms a product with the molecular formula C_4H_8O and this further reacts to form a compound with the molecular formula $C_4H_8O_2$.

(1) Describe the colour change that you would expect to see.

_____

[2]

(2) Write the **structure** and **name** of the first product with the molecular formula C_4H_8O.

[2]

(3) Write the **structure** and **name** of the second product with the molecular formula $C_4H_8O_2$.

[2]

(i) Butan-1-ol and butan-2-ol are both alcohols and have the same molecular formula ($C_4H_{10}O$), but have different structural formulae. What name is used to describe compounds of this type?

_____

[1]

(j) Butan-2-ol was reacted with acidified potassium dichromate solution.

(1) What type of alcohol is butan-2-ol? _____

[1]

(2) Draw the **structure** and write the **name** of the product of the oxidation.

[2]

(k) Draw the structure of another alcohol that has the molecular formula ($C_4H_{10}O$), but will **not** react with acidified potassium dichromate solution.

[1]

(l) Some butan-1-ol was heated with ethanoic acid in the presence of a little dilute sulfuric acid, producing a sweet smelling liquid.

(1) To what group of compounds does the sweet smelling liquid belong? i.e. name the funtional group present.

_____

[1]

(2) Write the **structure** and **name** of this product.

[2]

(3) Name the other compound formed in the reaction.

_____

[1]

Total marks 35