

SYDNEY BOYS HIGH SCHOOL



PRELIMINARY CHEMISTRY YEARLY EXAMINATION

2004

Instructions

- Reading time: 5 minutes
- Working time: 2 hours
- Use a blue or black pen
- Answer all questions on the answer sheets provided
- A data sheet and periodic table are provided

Part A - 16 Multiple choice questions (16 marks)

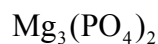
Part B - 16 Extended response questions (60 marks)

PART A - Multiple choice questions (16 marks)

Attempt all questions

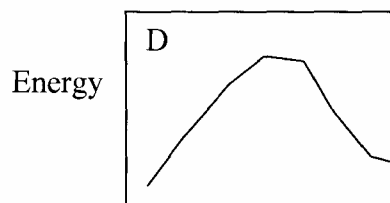
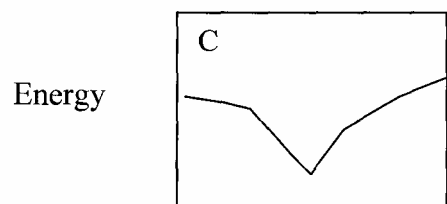
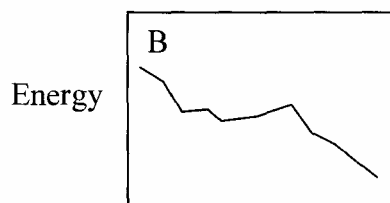
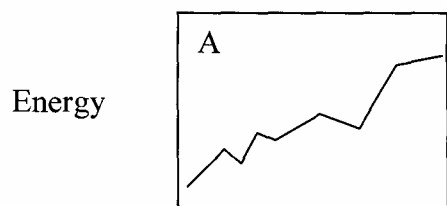
Select the most correct answer and place a cross in the appropriate space on the answer sheet.

1. Which of the following is the correct name for the following compound?



- A Magnesium phosphate
 - B Manganese diphosphate
 - C Trimagnesium diphosphate
 - D Magnesium phosphorus oxide
2. Which one of the following is a correctly written formula?
- A Na_2NO_3
 - B H_3OP_4
 - C NH_4OH
 - D $\text{K}(\text{PO}_4)_3$
3. The property that would be most important in deciding how to separate a mixture of sodium chloride and lead bromide would be:
- A their solubilities
 - B the colour of the lead compound
 - C their ability to evaporate at temperatures above 100°C
 - D the fact that the bromide and chloride belong to different groups on the periodic table
4. Graphite and diamonds are both made from carbon and are almost identical except for one main feature, graphite is very soft and diamonds are one of the hardest known substances. Which of the following is a common property shared by them?
- A They are both metallic solids
 - B They are both ionic solids
 - C They are both covalent network solids
 - D They can both under normal circumstances conduct electricity
5. Select the group that contains only molecules.
- A Water, methane, copper chloride
 - B Hydrogen, sulfur, argon
 - C Ethane, lead, diamond, oxygen
 - D Bromine, fluorine, silicon dioxide, water

6. As you follow the elements from left to right across the second period, which of the following best describes the general trend in first ionisation energy?



7. Given that there are 6.02×10^{23} particles in one mole of any substance, calculate the mass of water containing 3.3×10^{23} atoms.

- A 9.9g
- B 3.3g
- C 6.6×10^{23}
- D 5.2×10^2

8. The energy cost to extract two moles of copper from copper (II) oxide is 313.89 kJ. Calculate the mass of copper that can be derived from 1000 kJ.

- A 40,480 g
- B 1.7 kg
- C 430 g
- D 405 g

9. Which of the following characteristics of water cannot be explained by intermolecular forces?

- A Surface tension
- B Viscosity
- C Boiling point and melting point
- D Covalent bonds between hydrogen and oxygen

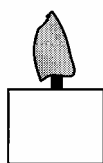
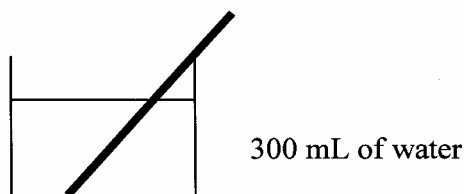
10. 50 mL of 0.2 moles.L⁻¹ is taken from a 500mL solution and added to a second beaker to make a total of 400 mL. Calculate the concentration of the second solution.

A 0.25 moles/L
B 0.011moles/L
C 2.5×10^{-2} moles/L
D 0.11 moles/L

11. 100 mL of 0.1 mol. L⁻¹ potassium sulfate is added to 100 mL of 0.2 mol.L⁻¹ Ba(NO₃)₂. Calculate the mass of the precipitate formed. (Hint: write a balanced equation)

A 2.3 g
B 56.3 g
C 0.55 g
D 11.9 g

12.



Ethanol burner

A student is carrying out an experiment to determine the molar heat of combustion of ethanol using the equipment above. The student finds that the water bath increases its temperature from 24⁰ C to 38⁰ C when the mass of the burner changes by 1.8 g. While there will be differences due to inaccuracies in the experimental technique, if the published molar heat of combustion for ethanol is 1364kJ. determine the difference between this and what the student should calculate.

A 914 kJ
B 451 kJ
C 213 kJ
D 134 kJ

13. The primary and original chemical reaction that "fixed" the energy that is currently stored in coal was:

A metabolism
B heat capacity
C photosynthesis
D glucose

14. Which of the following is a possible carbon based molecule?

- A $\text{CH}_2\text{CH}_2\text{CH}_3$
- B CO_3
- C $\text{CH}_3\text{CHCH}_2\text{CH}_3$
- D $\text{CH}_3(\text{CH}_2)_3\text{CHCH}_2$

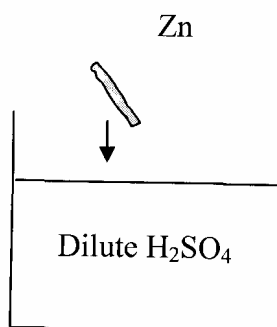
15.

Compound	BP($^{\circ}\text{C}$)	MP($^{\circ}\text{C}$)
Methane	-162	-183
Ethane	-89	-183
Propane	-42	-188
Butane	-1	-138
1-butene	-6.3	-185

In reference to the above table, which of the following is the most correct?

- A Ethane has less attraction between its molecules than methane.
- B The table is an example of an homologous series
- C Single bonds may assist in higher intermolecular attraction than double bonds
- D Butane is more flammable than ethane.

16.



When a small lump of zinc is dropped into a solution of sulfuric acid, there is a reaction. Which of the following best describes this reaction.

- A Electrons are transferred from the zinc to the hydrogen ion forming H_2 gas.
- B The sulfate ion transfers electrons to the zinc so that it can ionise in the water
- C The zinc acts as a catalyst to allow the hydrogen to be liberated as H_2 gas
- D The sulfate breaks down to form sulfur dioxide and leaves a salt behind

SYDNEY BOYS HIGH

NAME_____

TEACHER:_____

PART A:

Question	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Name: _____
Teacher: _____

PART B (60 marks)

Attempt Questions 17-32
Answer all questions on the paper

Question 17

A hand full of sand, pebbles and sodium chloride are thrown into a container of water. 3
Outline and explain the science behind the procedure you would use to separate them.

Question 18

Write a complete and balanced chemical equation of the following reactions 2

a) Calcium + oxygen \rightarrow

b) Magnesium + hydrochloric acid \rightarrow

Name: _____

Teacher: _____

Question 19

(a) Outline why copper was discovered before iron.

2

(b) Stainless steel and wrought iron are two different types of alloys of iron available in society today. Define the term "alloy" and describe two alloys you have studied this year and relate their properties to their usage.

3

Name: _____

Teacher: _____

Question 20.

You are about to conduct an experiment involving the following reactions:

Calcium and water Calcium and dilute hydrochloric acid Zinc and water Zinc and hydrochloric acid

Predict what will happen in each reaction and describe one safety procedure you should carry out before starting the experiment.

Name: _____
Teacher: _____

Question 21

- (a) Briefly outline how the different states of matter of water affect life on Earth. 2

- (b) Outline an experiment to determine the effect sodium chloride or anti-freeze has on the boiling point of water. Predict the results and give a reason for your prediction. 3

Name: _____
Teacher: _____

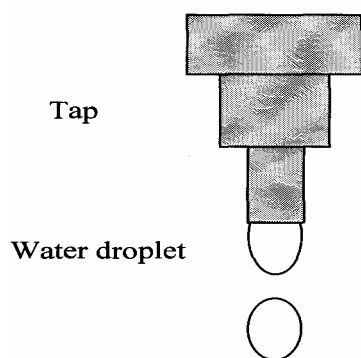
Question 22

- (a) Compare the molecular structure of the following substances and explain why their boiling points are different.

<u>Substance</u>	<u>BP($^{\circ}\text{C}$)</u>
Water	100
Ammonia	-33
Hydrogen sulfide	-62

- (b)

2



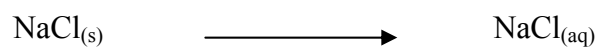
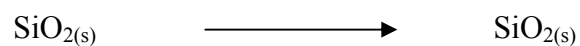
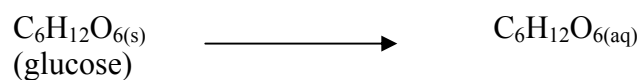
Briefly outline the science behind the reason water droplets form as shown in this diagram

Name: _____
Teacher: _____

Question 23

- (a) A student dissolved 54g of sodium carbonate in 600 mL of water. Determine the concentration of sodium ions in the solution and the number of oxygen atoms in the carbonate ion. 2

- (b) The following substances are placed in 100ml of water in separate beakers. Discuss the particle arrangement after they have entered the water. Use diagrams if necessary. 3



Name: _____

Teacher: _____

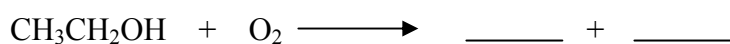
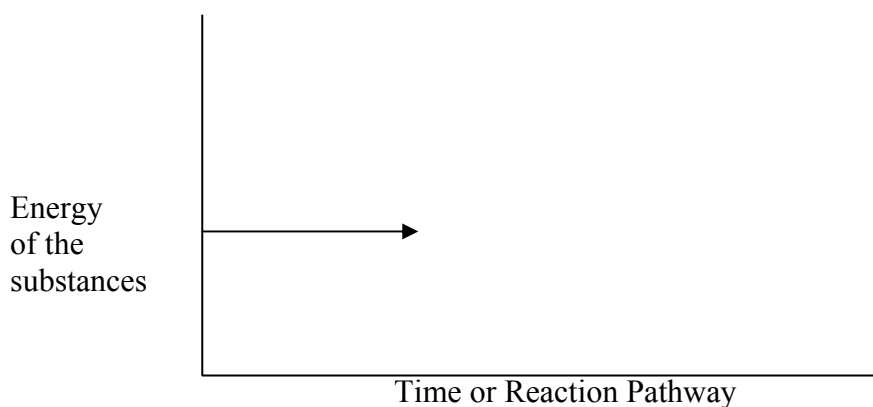
Question 24

Using drawings to model the different arrangements of the atoms in diamond, graphite and fullerenes.

3

Question 25

2



- (a) The reaction of ethanol is exothermic. Complete the above equation.
- (b) Complete and fully label the above energy graph of the reaction. The heat of combustion of ethanol is 1364 kJ.mol^{-1} .

Name: _____

Teacher: _____

Question 26

- (a) Use the periodic table to help you compare and contrast the properties of chlorine and potassium. 2

- (b) Write equations showing the ionisation of the following elements:

(i) K \longrightarrow

(ii) Al \longrightarrow

(iii) O \longrightarrow

Name: _____

Teacher: _____

Question 27

- (a) Compare the electronegativity of the following elements and give reasons for your answer. 2

F
C
Li
O
Ne

- (b) A reaction involved 12g of magnesium and an excess of dilute sulfuric acid. 3
Calculate the volume of gas produced at 25⁰C and 100 kPa. Show all working.

Name: _____

Teacher: _____

Question 28

A student was asked to compare the properties of two compounds, X and Y.
The properties observed are:

Compound	X	Y
Melting Point	High	Low
Electrical conductivity of solid	very low	very low
Electrical conductivity of molten Compound	High	very low
Electrical conductivity of aqueous Solution	High	very low

- (a) Explain why X is a poor conductor of electricity when solid, yet it is very good conductor in solution and in molten state. 2

- (b) Identify the type of bonding present in compound Y 1

Name: _____

Teacher: _____

Question 29

Below are some common properties of some hydrocarbons, which are used as fuels.

Fuel	Heat of Combustion MJ kg ⁻¹	Boiling point °C	Ignition temperature °C
butane	49	-0.5	430
pentane	49	36.1	284
hexane	48	68.7	260
Heptane	48	98.4	247

- (a) (i) Which of the above fuels is the most volatile? 1

- (ii) Under what conditions can this fuel be stored? 1

- (b) Account for the differences in boiling points of the hydrocarbons. 1

- (c) Which hydrocarbon would have the highest activation energy when it undergoes combustion? Explain your answer. 1

Name: _____
Teacher: _____

Question 30

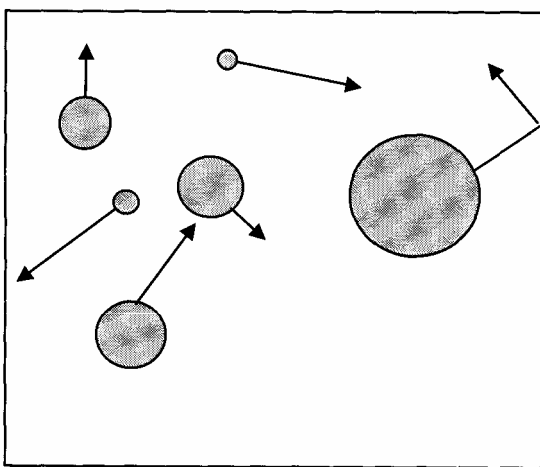
(a) Wood is mainly made from cellulose which is a combustible material 3

(i) What makes cellulose flammable?

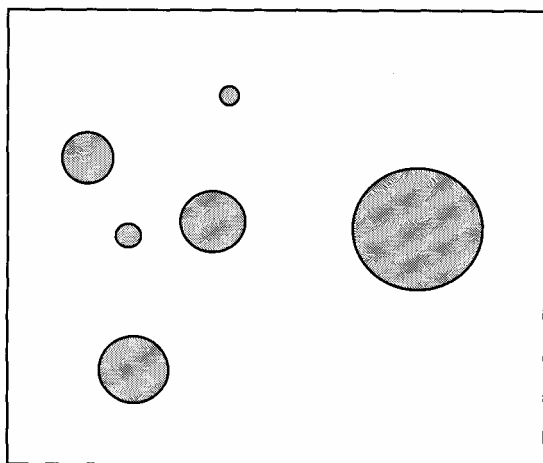
(ii) How can a log of wood be changed to increase the rate at which it burns?

(iii) Describe the movement of mass during the combustion of wood.

(b) 2



(i) The above diagram is a model of the motion of molecules in a gaseous mixture at 20°C . Use the diagram below to display a similar model of the same gaseous mixture at 50°C .



(ii) Explain how reaction rate is affected by temperature.

Name: _____
Teacher: _____

Question 31

A student decomposed some copper carbonate by heating, and tested for the production of carbon dioxide.

Draw and label the equipment the student could use to carry out this investigation.

2

Question 32

An Homologous Series

The Alkanes

Methane

Ethane

Propane

Butane

Pentane

Hexane

Heptane

Octane

Why are the Alkanes called an "homologous series"?

1
