Name: ……………………………………………..

Teacher: ……………………………………………..

BAULKHAM HILLS HIGH SCHOOL

YEARLY EXAMINATION

2008

YEAR 11

CHEMISTRY

General Instructions

- Reading Time – 5 minutes
- Working Time – 2 hours
- Write, using black or blue pens
- Draw diagrams using pencil
- Data Sheet and Periodic Table are provided on the back of this paper.

Total 65 marks

Part A (15 marks)

15 Multiple Choice questions worth 1 mark each

Part B (50 marks)

- All questions are compulsory
- Answer in the allocated spaces

Part A (15 marks)
This section contains 15 Multiple Choice questions worth 1 mark each)

1. An example of a purely physical change is

    a) burning methane
    b) dissolving salt in water
    c) breaking a glass bottle
    d) rusting of iron

2. An element Z forms an ion Z^{2+}. The atom Z and the ion Z^{2+} have the same

    a) radius
    b) ionization energy
    c) nuclear charge
    d) chemical properties

3. Copper is used to make electrical wiring however iron is cheaper to produce than copper. One reason why iron is NOT used to make the wiring is because it

    a) is difficult to extract pure iron from its ore
    b) it is not ductile
    c) is more reactive than copper
    d) has less electrons in each of its atoms compared to copper

4. Within a homologous series such as the alkanes, the boiling points

    a) decrease as the molecules become larger
    b) are all approximately the same
    c) increase as the molecular weights increase
    d) are independent of molecular weight

5. Graphite is an excellent lubricant because

    a) the weak dispersion focus between the crystalline layers is susceptible to shearing forces
    b) its atoms are strongly bonded in three dimensions
    c) it does not readily oxidise
    d) mobile electrons exist in the plane of the interconnecting rings

6. When propane is burnt completely 2240 kJ of heat are released for each mole of propane burnt. Which of the following equations correctly represents this reaction?

    a) $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l) \quad \Delta H = -2240kJ$
    b) $C_5H_{12}(g) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(l) + 2240kJ$
    c) $C_3H_8(g) + 5O_2(g) + 50.9kJ \rightarrow 3CO_2(g) + 4H_2O(l)$
    d) $C_5H_{12}(g) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(l) \quad \Delta H = -50.9kJ$

7. For each mole of glucose formed in photosynthesis

   a) 1 mole of oxygen is also formed
   b) 6 moles of water has reacted
   c) 2816 kJ of energy is released
   d) 1 mole of carbon dioxide is consumed

8. Some insects, such as water striders are able to walk across the surface of freshwater pools. Which property of water makes this possible?

   a) large molecular size
   b) high surface tension
   c) high density
   d) high viscosity

9. Mendeleev's historical Periodic Table was particularly significant because

   a) he was unable to define an element
   b) many elements had not been discovered
   c) it was based on a Law of Octanes
   d) he did not use physical and chemical data already known

10. Examine the following potential energy diagram for a chemical reaction.
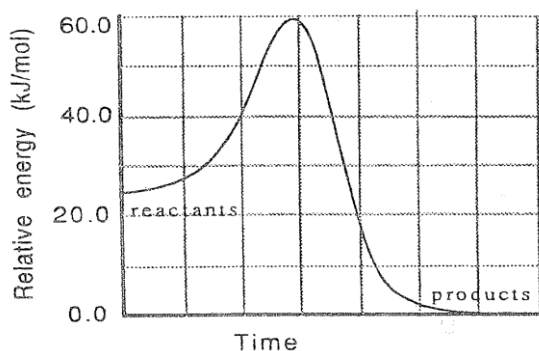
   The enthalpy change ΔH and the activation energy E_a in kJ/mole for the reaction respectively:

   a) ΔH = -25 kJ and E_a = 35 kJ
   b) ΔH = +25 kJ and E_a = 35kJ
   c) ΔH = 35 kJ and E_a = 60 kJ
   d) ΔH = -60 kJ and E_a = 35 kJ

11. Which one of the following compounds has a molecular formula which is identical to its empirical formula?

   a) methane
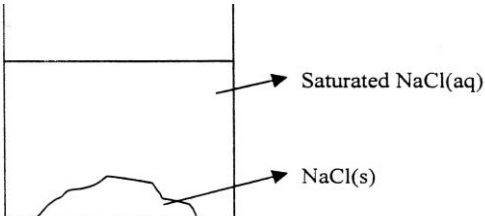   b) ethane
   c) propane
   d) butane

3

12. 100mL of 0.20 mol L^{-1} lead nitrate solution is added to 100 mL of 0.20 mol L^{-1} sodium iodide solution. What molar quantity of lead iodide precipitate is formed?

a) 0.01 mole
b) 0.02 mole
c) 0.03 mole
d) 0.10 mole

13. This question refers to the substance with the molecular structure shown below.
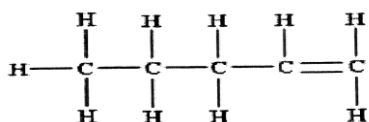
Which of the following is the name of this compound?

a) 4-pentene
b) 1-pentene
c) 1-butane
d) 2-butane

14.

The system above consists of a saturated salt solution with some undissolved salt crystals in it. At the point of equilibrium

a) both solution and precipitation have stopped
b) the rate of solution is greater than the rate of precipitation
c) the rate of solution is less than the rate of precipitation
d) both solution and precipitation are occurring at an equal rate

15. The table below lists some properties of two chlorine compounds.

Compound	Melting Point ºC	Conductivity in Aqueous Solution	Conductivity in the Molten State
Hydrogen chloride	-114	Very good	Nil
Potassium chloride	770	Very good	Very good

The reason for the difference in melting points is that

a) the covalent bands present in HCl are weaker than the ionic bonds present in KC1
b) the ionic bonds present in HC1 are weaker than those present in KC1
c) the dispersion forces present in KC1 are stronger than those in HC1
d) the intermolecular forces in HC1 are weaker than the ionic bonds present in KC1

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MULTIPLE CHOICE ANSWER SHEET

Place a (X) in the box that corresponds to the best answer.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D

9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D

SECTION	MARK
A	/15
B	/50
Total	/65

Part B　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**Mark**
This section is worth 40 marks and contains questions of varying length and value.
Write your answers in the spaces provided.

16. Distinguish between a mineral and an ore.　　　　　　　　　　　　　　　**2**

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17. Arrange the following set of elements in decreasing order of indicated property

    a) S, Ba, He, Mg   -   ionization energy　　　　　　　　　　　　　**1**

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    b) K, Li, He, O   -   electro negativity　　　　　　　　　　　　　**1**

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18. Outline why copper was discovered before iron.　　　　　　　　　　　1

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19. 2.00 g of a straight-chained hydrocarbon contains 1.68 g of carbon and the rest, hydrogen.. **2**

    a) Calculate the empirical formula of this hydrocarbon. (Show working)

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    b) The molecular formula of this hydrocarbon is the same as its empirical formula.　**1**
        Name the hydrocarbon.

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20. If a solution of lead (II) nitrate is mixed with a solution of potassium iodide, a bright yellow precipitate is formed.

    a) Write a balanced chemical equation for this reaction. **1**

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    b) Write a net ionic equation for this reaction. **1**

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    c) Calculate the concentration of the resulting solution when 15.0 mL of 0.25 mol.L^{-1} lead nitrate is mixed with 15.0 mL of 0.25 mol.L^{-1} potassium iodide. **2**

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21. The melting points and boiling points of three hydrides are given in the table below.

Compound	CH_4	NH_3	H_2O
Melting Point (ºC)	-183	-78	0
Boiling Point (ºC)	-162	-33	100

    a) Using Lewis diagrams, compare the molecular structures and shapes of these molecules. **3**

21. b) Assess the importance of polarity and hydrogen bonding to the range and melting   **3**
         and boiling points shown by these compounds.

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22. When excess steam is passed over 0.6g of heated magnesium, hydrogen is produced.

     a) Write a balanced chemical equation for this reaction.   **1**

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     b) Find the volume of hydrogen gas produced at 25°C and 100 kPa pressure.   **2**

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23. Identify some of the safety issues associated with use of alkanes in the laboratory and   **3**
     describe precautions that could be used to address these issues.

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24. The following diagram is a reaction profile for the decomposition of hydrogen peroxide into water and oxygen.
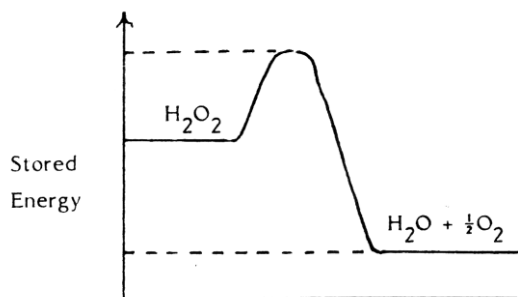
a) How would you expect the temperature of a sample of H_2O_2 in an insulated container to vary as it decomposes? Explain.

2

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b) Manganese dioxide can be used as a catalyst to speed up the decomposition reaction. What effect would the MnO_2 have on the enthalpy change of the reaction?

1

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25. Explain why a candle needs a wick to burn.

2

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26. i) Relate the bonding in water to its ability to dissolve a large range of substances.

2

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ii) Account for the inability of water to dissolve hydrocarbons.

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27. Evaluate the need to recycle aluminium.

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28. The table shows some of the results of tests that were done with four divalent metals, W, X, Y and Z.

Metals	Reaction With		
	Hydrochloric acid	**Cold water**	**Steam**
W		No reaction	Reaction
X	No reaction		
Y	Reaction		No reaction
Z		Reaction	

Place these metals in order of decreasing activity and justify the criteria used. **3**

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29. Explain how fine coal dust in a coal mine can be an explosive hazard? **2**

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30. a) Write out the electron configuration of carbon.

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b) Carbon contains several allotropes. Explain the term *allotrope*.   1

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c) Name each of the three allotropes below and in each case, state a physical property   3
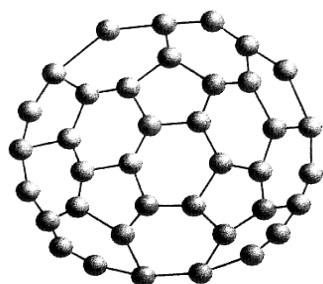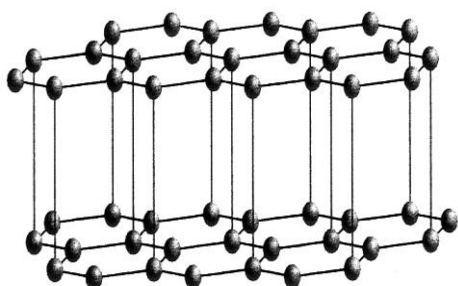due to the structure of that allotrope.
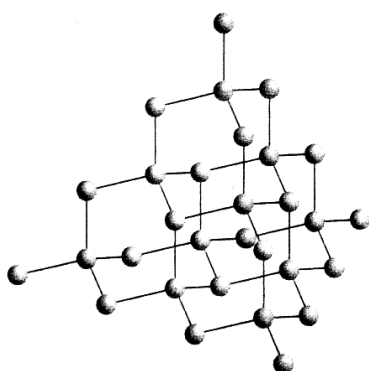
Name:..

Physical Property: ....

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C_{60}

Name: ....

Physical Property: ....

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Name: ....

Physical Property: ....

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31. 15 g of magnesium metal is reacted with 0.125 g hydrochloric acid (HCl) until no further reaction occurs.

    a) Write a balanced equation. **1**

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    b) Name the limiting reagent. **2**

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    c) What mass of excess reagent is left over? **2**

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End of Paper

MC
1. B & C   2. C   3. C   4. C   5. A
6. A   7. B   8. B   9. B   10. A
11. A & C   12. B   13. B   14. D   15. D

16.

Criteria	Mark
Identifies a mineral as a homogeneous substance that is a naturally occurring inorganic compound or element. AND Identifies that an ore is an economically viable concentration of a useful mineral	2
Identifies a mineral as a homogeneous substance that is a naturally occurring inorganic compound or element. OR Identifies that an ore is an economically viable concentration of a useful mineral	1

17a.

Criteria	Mark
Provides the correct order for decreasing ionisation energy ie. He>S>Mg>Ba	1

17b.

Criteria	Mark
Provides the correct order for decreasing electronegativity ie. O>Li>K>He	2

18.

Criteria	Mark
States that copper is less reactive than iron. AND EITHER States that copper requires less energy to extract it from its compounds OR States that copper can be found in an uncombined state	2

19a.

Criteria	Mark
Shows correct way to set up mole ratio $1.68/12$ mol C : $0.32/1.008$ mol H Calculates correct empirical formula from mole ratio $7 : 16$ or C_7H_{16}	2
Shows correct way to set up mole ratio $1.68/12$ mol C : $0.32/1.008$ mol H	1

19b.

Criteria	Mark
Identifies the compund to be heptane	1

20a.

Criteria	Mark
Gives correctly balanced equation with subscripts $Pb(NO_3)_2$ (aq) + 2KI(aq) ----> PbI_2 (s) + 2 KNO_3(aq)	1

20b.

Criteria	Mark
Gives correctly balanced net ionic equation (no subscripts) Pb^{2+} + $2I^{1-}$ ----> PbI_2	1

20c.

Criteria	Mark
Correctly calculates the number of moles of one compound Correctly calculates the concentration of at least one species present in the combined solutions after reaction has taken place.	2
Correctly calculates the number of moles of one compound	1

This question was incorrectly written and as it was a limiting reagent question there was no single species remaining in solution. Best answer gives-
$[Pb(NO_3)_2] = 0.062$ mol/L   and $[KNO_3] = 0.125$ mol/L in the resulting combined solution.

21 a)

3 correct Lewis structures AND their names	3
2 correct Lewis structures AND their names OR 3 correct Lewis structures and one correct structure OR 3 correct structures and one correct Lewis structure	2
One correct Lewis structure and its correct shape OR 3 correct Lewis structures OR 3 correct shapes	1

b)

*CH_4 – non-polar, weak dispersion forces, so low BP & MP *NH_3 – polar molecule, dipole-dipole/hydrogen bonding, stronger than dispersion forces, so higher BP & MP than CH_4 H_2O – polar molecule, hydrogen bonding, oxygen has higher electronegativity than nitrogen, so hydrogen bonding stronger than in ammonia, hence higher BP & MP than ammonia	3
Any two of the points above	2
Any one of the above	1

22 a) $H_2O_{(g)}$ + $Mg_{(s)}$ ------------> $MgO_{(s)}$ + $H_{2(g)}$

b) $n = (0.6/24.31)$ X   24.79L   1 mark

         = 0.6L   1 mark

23

3 safety issues AND 3 appropriate precautions	3
2 safety issues AND 2 appropriate precautions	2
One safety issue AND an appropriate precaution	1

24a

criteria	mark
-The sample in the insulated container would become **warmer** -The reaction is **exothermic** as the energy of the products is less than the energy of the reactants. This energy is given out as heat.	2
one of the above	1

24b
A catalyst has no effect on the enthalpy change.   1 mark

25

criteria	mark
-The fuel needs to be in the **gaseous** form. -The wick allows the liquid fuel to be drawn up by **capillary action**. This **increases surface** area and helps the liquid to vaporize.	2
one of the above	1

26i)

criteria	mark
-Description of water as a polar molecule. The intramolecular bonds are polar with a slightly negative end (oxygen) and a slightly positive end (hydrogen). -Description of how waters polarity enables it to dissolve other molecules and compounds eg ionic compounds.	2
one of the above	1

26(ii) Hydrocarbons are non-polar and therefore do not easily dissolve in a strongly polar substance like water. 1 mark

27

criteria	mark
-Develop an argument about the need to recycle aluminium -Include at least two reasons either for/against the recycling of aluminium. -Give an evaluation	3
two of the above	2
one of the above	1

28

criteria	mark
-Give correct order Z W Y X. -Address each of Z W Y and Z in turn giving an explanation for each.	3
Give correct order Z W Y X plus partial address of Z W Y and Z.	2
Give correct order Z W Y X or partial address of Z W Y and Z.	1

Q29

'Explain' – cause and effect

mark	criteria
2	• Relate **large surface area** of the coal dust which is in contact **with O_2/air.** • Causes **increases in collisions**, and therefore, successful collisions. *(or*, requires only a **spark** to ignite)
1	2 of the above three points

Q30   a. carbon is 2, 4. (1 mark).
        b. different forms of the same element, with different physical properties. (1 mark)
        c. (1 mark for each combination of name and property.)
        Eg:
    • Diamond - hard
    • Buckminster fullerene (not just 'fullerene'- there are more than one) -slippery
    • Graphite – conductor

Q31.   a) $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

    b)

mark	criteria
2	• Calculate the number of moles of each present • Name the limiting reagent (which was HCl)
1	• Name the limiting reagent (which was HCl)

    c)

mark	criteria
2	• Calculation of mass of Mg left • Answer to 2 sig figs
1	• Calculation of mass of Mg left • Answer not to 2 sig figs