Baulkham Hills High School

Yearly Examination

2012

YEAR 11

CHEMISTRY

GENERAL INSTRUCTIONS

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen (black pen preferred)
- Draw diagrams using pencil
- Write your name and teacher's name at the top of your answer booklet

TOTAL MARKS – 75 marks

Section I – Multiple Choice
15 marks
Pages 1-6

Section II – Short Response
60 marks
Attempt ALL Questions
Pages 7-16

Section I – Multiple Choice
15 marks
Select the most correct response A,B,C or D which best answers the question by placing an 'X' on the Multiple Choice Answer Grid.

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1. Millicent was carrying out an experiment to separate out components of a mixture which consisted of salt, water, iron and sand. She used filtration, evaporation and a magnet to separate the four components of the mixture. Her results are summarised in the table below.

Sample	Mass (g)
Mass of sample	10.5
Mass of iron filing	3.2
Mass of filter paper	0.9
Mass of filter paper plus residue	2.9
Mass of evaporating basin	28.3
Mass of evaporating basin plus solution before heating	33.6
Mass of evaporating basin plus crystal after heating	30.6

The percentage of salt in the mixture is closest to

a) 19%
b) 22%
c) 31%
d) 50%

2. Photosynthesis is an important process that generates energy.
Identify a correct statement from below about factual information about photosynthesis.

a) Photosynthesis has to use carbohydrate for its initial chemical reaction
b) Photosynthesis is an exothermic reaction because glucose contains 2803kJ of energy
c) Photosynthesis is the most efficient process of stabilising solar energy
d) Photosynthesis requires 12 moles of water to produce one mole of glucose

3. The table below shows an analysis of samples of Australian fossil fuels.
Use the information in the table to identify the correct categories of the samples

Sample	Composition
A	90% CH_4; 6% C_2H_6; 4% mixture of other gases
B	10% H_20; 15% alkanes; 16% cyclohexanes; 12% aromatics; 47% carbon
C	58% alkanes; 4% alkenes; 16% cycloalkanes; 12% aromatics; 10% polycyclics

	Natural Gas	Petroleum	Coal
a)	B	C	A
b)	C	A	B
c)	A	B	C
d)	A	C	B

4. A group of elements has the following properties:

Substance	Melting Point (°C)	Boiling Point (°C)	Electricity Conductivity	Colour
W	232	2770	good	silvery-white
X	-39	357	good	silvery-white
Y	-6	59	poor	red-brown
Z	217	814	fair	silvery-white

Which of the following statements is correct?

a) W, X and Y are all metals
b) X and Y are liquids at room temperature
c) W and X when bonded together will form a covalent bond
d) Z is a naturally occurring gas

5. The order of elements Ag, Mg, Pt, Na, Fe from the least active to most active is

a) Mg, Pt, Na, Fe, Ag
b) Na, Mg, Fe, Pt, Ag
c) Pt, Ag, Fe, Mg, Na
d) Na, Mg, Fe, Ag, Pt

6. Which sphere contains the lowest percentage of water?

a) Hydrosphere
b) Lithosphere
c) Atmosphere
d) Biosphere

7. Potassium has the following characteristics:

Molar mass	**39.1**
Colour	silver
Mp	64°C
State	Solid

Rubidium is below potassium in the periodic table.
Which of the following would be a correct statement about rubidium?

a) The molar mass would be less
b) It would be a golden colour
c) It would be a liquid
d) The melting point would be similar to that of potassium

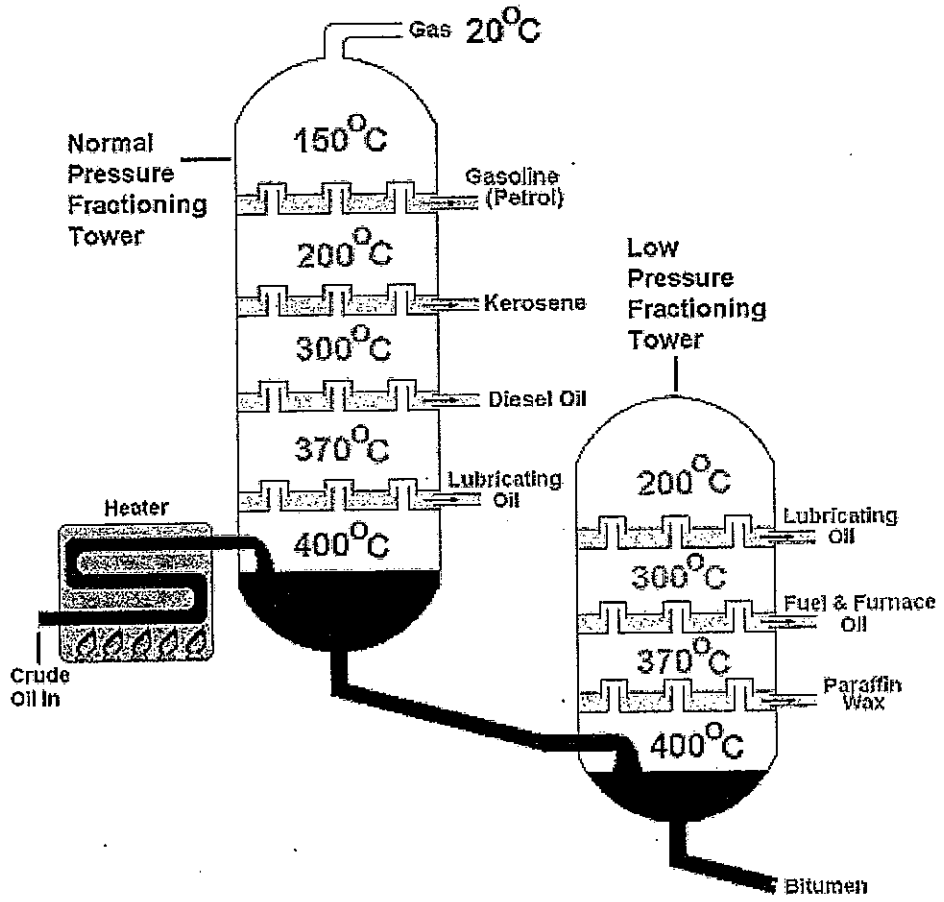
8. Which of these blast furnace reactions forms 'slag'?

a) calcium carbonate + silicon dioxide → calcium silicate + carbon dioxide
b) carbon dioxide + carbon → carbon monoxide
c) carbon + oxygen → carbon dioxide
d) iron (III) oxide + carbon monoxide → iron + carbon dioxide

9. Which one of the following is NOT typical of a homologous series?

a) Each successive member differs by CH
b) They have similar methods of preparation
c) Their physical properties show gradual change as size of compounds increase
d) Its members have a general formula

10. The diagram below shows the fractional distillation of crude oil.



Which of the following explains why the lubricating oil fraction is used as a lubricant?

a) Quite viscous but will not freeze or evaporate easily
b) Not too flammable and not viscous
c) Can be liquefied under pressure but easily changes back to a gas
d) A liquid that is easily vapourised and not too viscous

11. An experiment is designed to test the effect of temperature on the rate of the reaction between dilute hydrochloric acid and magnesium. The independent variable is

a) the temperature of hydrochloric acid
b) the volume of hydrochloric acid
c) the size and number of magnesium pieces
d) the rate at which hydrogen is produced

12. The electronic configuration of $^{19}_{9}F$ is

a) 2,7
b) 2,2,5
c) 2,7,8
d) 2,8,7

13. Mendeleev's historical periodic table was particularly significant because

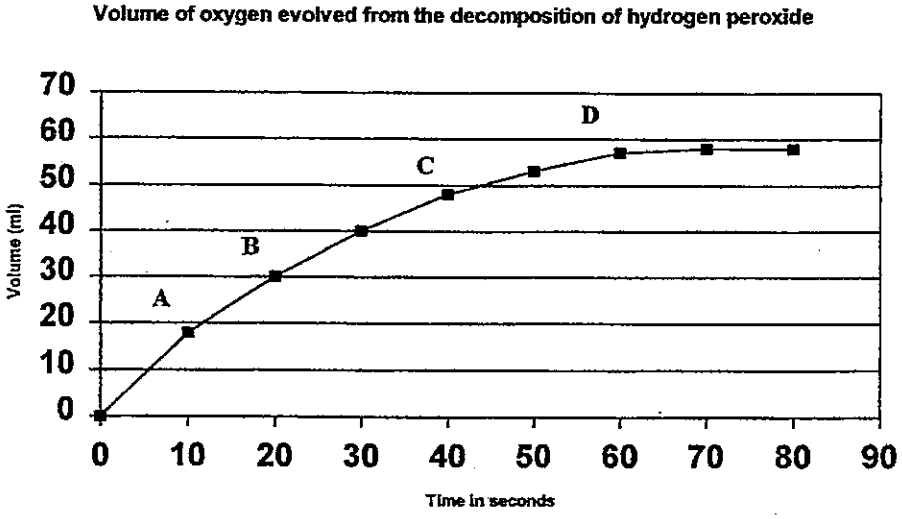
a) he was unable to define an element
b) many elements had not been discovered
c) it was based on Law or Octaves
d) he did not use physical and chemical data already known

Refer to the information below to answer Questions 14 and 15.

An experiment was performed to measure the amount of oxygen gas evolved at ten second intervals when 40mL of hydrogen peroxide was allowed to decompose according to the equation

$$2H_2O_{2(l)} \xrightleftharpoons{MnO_2} 2H_2O_{(l)} + O_{2(g)}$$

The reaction was carried out at 20°C and 0.5 g of manganese dioxide added at the start of the experiment. The results are shown in the graph below.

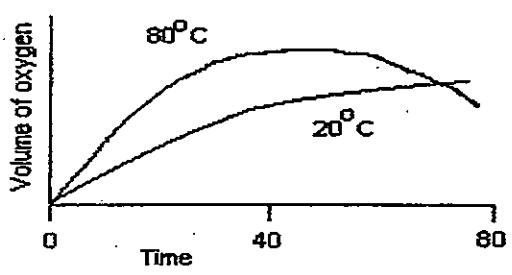


14. The manganese dioxide acts as a catalyst and increases the rate of decomposition of hydrogen peroxide. How is this thought to do this?

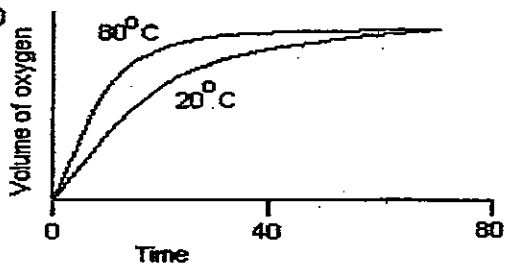
a) By lowering the activation energy of the reaction
b) By increasing the energies of hydrogen peroxide molecules, thus increasing the frequency of successful collisions between them.
c) By decreasing the rate of collisions between the product molecules, thereby decreasing the rate of the reverse reaction
d) Both b) and c)

15. If the hydrogen peroxide was heated to 80°C and then the magnesium dioxide added, which of the graphs below would show the expected results?

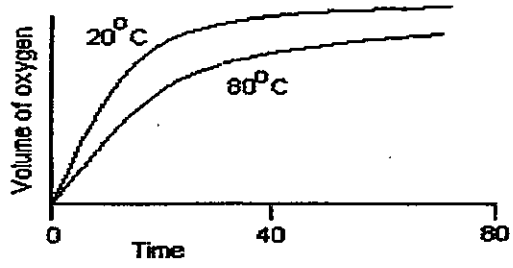
a)



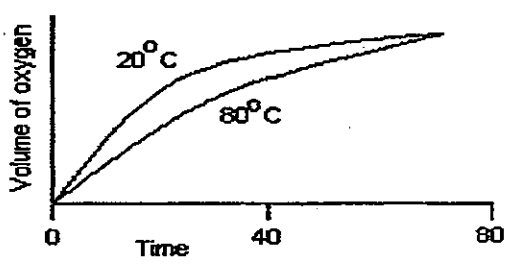
b)



c)



d)



End of Section I

Student Name: ..... Teacher: .....

Baulkham Hills High School

Yearly Examination

2012

Year 11

Chemistry

Section I
Multiple Choice (15 marks)

Select the most correct response A, B, C or D which best answers the question by placing an 'X' in the appropriate box on the grid below.

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 I	/15
Section II	/60
Total	/75

Section II – Short Response
60 marks
Attempt ALL questions
Write your answers in the spaces provided
Individual marks are indicated for each question

Marks

Question 16 (4 marks)

a) Identify TWO alloys and their uses **2**

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b) Explain why the range of alloys for use is much greater now than in the past. **2**

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Question 17 (4 marks)

Examine the role of water on Earth in controlling temperatures. **4**

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Marks

Question 18 (3 marks)

a) Identify both the raw materials needed for photosynthesis and products of photosynthesis. 1

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b) Explain whether photosynthesis is an endothermic or an exothermic process. 2

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Question 19 (3 marks)

Compare salt dissolving in water to sugar dissolving in water at the atomic and molecular level. 3

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Question 20 (2 marks)

ammonia NH_3 bromomethane CH_3Br methane CH_4 sodium chloride NaCl water H_2O

a) Which substance has dispersion forces as its only intermolecular force? 1

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b) In the space below, draw the structural formula of a substance from the list in which dipole-dipole interactions are the major intermolecular force 1

Marks

Question 21 (6 marks)

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

a) i) Describe the risks involved in this experiment. **1**

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ii) How would you minimise the risks in this experiment? **1**

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b) Draw up a table of expected observations for this experiment. **2**

Question 21 (continued) **Marks**

c) Write a word equation for the reaction between calcium and dilute hydrochloric acid Include states. **1**

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d) Write a symbol equation for the reaction between calcium and diluted hydrochloric acid. Include states. **1**

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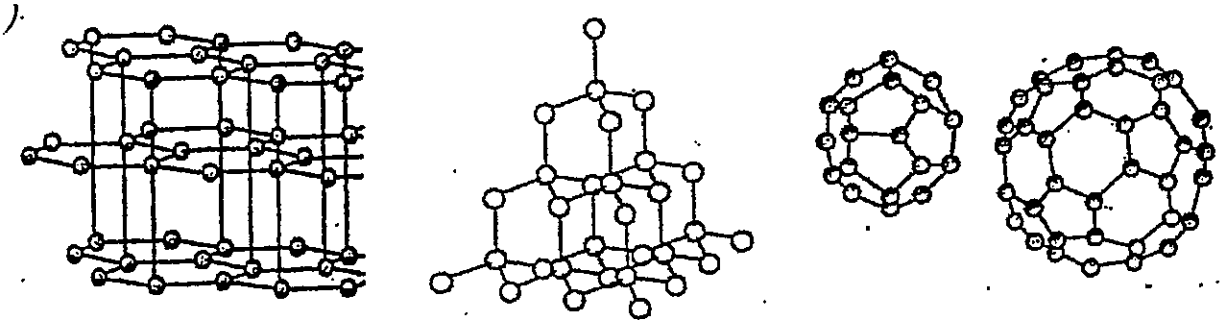
Question 22 (3 marks)

The diagram below shows the three allotropes of carbon-graphite, diamond and buckminsterfullerenes.



graphite **diamond** **buckminsterfullerenes**

Graphite is very soft and can be used as a lubricant. Diamond is very hard and can be used for cutting.

a) Based on their structures, explain why graphite is soft and diamond is hard. **2**

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b) Suggest ONE other use for diamonds. **1**

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Marks

Question 23 (8 marks)

In an experiment, 20.0g of lead (II) nitrate and 20.0g of potassium iodide were dissolved separately to form 250mL of lead (II) nitrate solution and 250mL of potassium iodide solution. The two solutions are then mixed together.

a) Write a balance chemical equation to represent the precipitation reaction. Include the state of the chemicals. **1**

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b) Identify the limiting reactant. Show working. **2**

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c) What is the maximum mass of lead (II) iodide that can be obtained from the experiment? Show working. **2**

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d) What is the concentration of potassium nitrate in the reaction mixture when the reaction is completed? **2**

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e) Write a net ionic equation for the above reaction. **1**

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Question 24 (3 marks)

In covalent molecular substances, the forces within molecules are strong but the forces between molecules are weak.

Explain what is meant by this statement, illustrating your answer with Chlorine (Cl_2) which has a melting point of -101°C but does not break up into separate atoms except at very high temperature. 3

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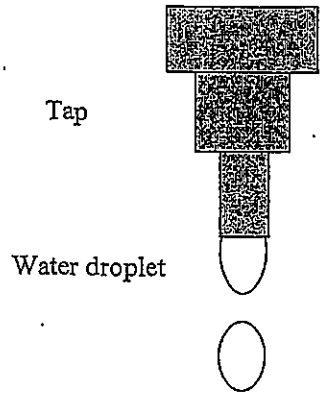
Question 25 (2 marks)

Briefly outline the science behind the reason water droplets form as shown in the diagram. 2



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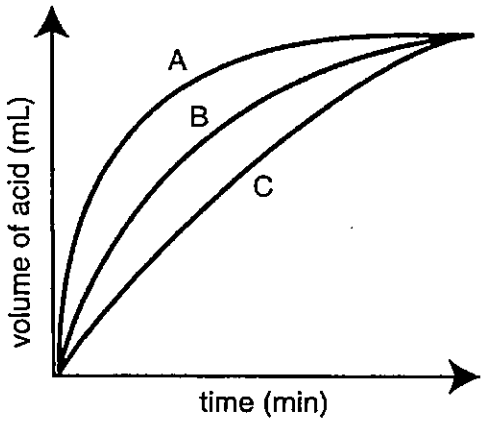
Marks

Question 26 (5 marks)

A student carried out an experiment to compare the rate of reaction between magnesium and hydrochloric acid using three different concentrations of acid.. To assess the rate of reaction she measured the volume of hydrogen released at intervals.

From the results, she drew the following graphs.



If the concentrations used were 0.5, 1.3 and 2.0 mol L^{-1}

a) Which graph would have been based on the results obtained from using the 2 mol L^{-1} acid? 1

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b) Write a conclusion for this experiment. 1

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c) Identify THREE variables that need to be kept constant during this experiment. 2

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d) Outline measures you could take to improve the reliability of this experiment. 1

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Marks

Question 27 (4 marks)

For each of the following types of substances give an example, a use for each and a a property which relates to that use. 4

Substance	Example	Use	Property
metallic			
ionic			
covalent			
covalent network			

Question 28 (3 marks)

Heat energy is released when anhydrous calcium chloride is dissolved in water.

Calculate the final temperature when 0.01 mol of calcium chloride is dissolved into 150mL water at a temperature of 18.0°C. The enthalpy of solution is -120kJ.mol^{-1}. 3

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Marks

Question 29 (5 marks)

Julia and Minh, two Year 11 Chemistry students were studying the heat capacities of some metals (cu, Pb, Fe, Al).

They placed 1cm cubes of the four metals at the same initial temperature, onto a large block of ice (0°C).

They obtained the following data from their text:

Metal	Density gcm $^{-3}$	Specific Heat Capacity $JK^{-1}g^{-1}$
Cu	8.96	0.39
Pb	11.3	0.13
Fe	7.86	0.45
Al	2.70	0.90

a) Identify which of the cubes would have the greatest mass. **1**

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b) Calculate which of the cubes would lose the most energy in cooling down to the ice's temperature. **2**

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c) Assuming that each cube forms a neat square shaft (1cm x 1cm) as it sinks into the ice, identify which one would sink the smallest distance into the ice. **2**

Justify your answer.

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Question 30 (5 marks) **Marks**

Metals can be extracted from their ores or from recycling old materials.

Using an example of a metal which you have studied, compare the two methods, both in terms of the processes involved and the implications of each for society. **5**

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End of Paper

PERIODIC TABLE OF THE ELEMENTS

1 H 1.008 Hydrogen																	2 He 4.003 Helium
3 Li 6.941 Lithium	4 Be 9.012 Beryllium											5 B 10.81 Boron	6 C 12.01 Carbon	7 N 14.01 Nitrogen	8 O 16.00 Oxygen	9 F 19.00 Fluorine	10 Ne 20.18 Neon
11 Na 22.99 Sodium	12 Mg 24.31 Magnesium											13 Al 26.98 Aluminium	14 Si 28.09 Silicon	15 P 30.97 Phosphorus	16 S 32.07 Sulfur	17 Cl 35.45 Chlorine	18 Ar 39.95 Argon
19 K 39.10 Potassium	20 Ca 40.08 Calcium	21 Sc 44.96 Scandium	22 Ti 47.87 Titanium	23 V 50.94 Vanadium	24 Cr 52.00 Chromium	25 Mn 54.94 Manganese	26 Fe 55.85 Iron	27 Co 58.93 Cobalt	28 Ni 58.69 Nickel	29 Cu 63.55 Copper	30 Zn 65.38 Zinc	31 Ga 69.72 Gallium	32 Ge 72.64 Germanium	33 As 74.92 Arsenic	34 Se 78.96 Selenium	35 Br 79.90 Bromine	36 Kr 83.80 Krypton
37 Rb 85.47 Rubidium	38 Sr 87.61 Strontium	39 Y 88.91 Yttrium	40 Zr 91.22 Zirconium	41 Nb 92.91 Niobium	42 Mo 95.96 Molybdenum	43 Tc Technetium	44 Ru 101.1 Ruthenium	45 Rh 102.9 Rhodium	46 Pd 106.4 Palladium	47 Ag 107.9 Silver	48 Cd 112.4 Cadmium	49 In 114.8 Indium	50 Sn 118.7 Tin	51 Sb 121.8 Antimony	52 Te 127.6 Tellurium	53 I 126.9 Iodine	54 Xe 131.3 Xenon
55 Cs 132.9 Caesium	56 Ba 137.3 Barium	57–71 Lanthanoids	72 Hf 178.5 Hafnium	73 Ta 180.9 Tantalum	74 W 183.9 Tungsten	75 Re 186.2 Rhenium	76 Os 190.2 Osmium	77 Ir 192.2 Iridium	78 Pt 195.1 Platinum	79 Au 197.0 Gold	80 Hg 200.6 Mercury	81 Tl 204.4 Thallium	82 Pb 207.2 Lead	83 Bi 209.0 Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89–103 Actinoids	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium						

KEY

Atomic Number
Symbol
Standard Atomic Weight
Name

79 Au 197.0 Gold

Lanthanoids

57 La 138.9 Lanthanum	58 Ce 140.1 Cerium	59 Pr 140.9 Praseodymium	60 Nd 144.2 Neodymium	61 Pm Promethium	62 Sm 150.4 Samarium	63 Eu 152.0 Europium	64 Gd 157.3 Gadolinium	65 Tb 158.9 Terbium	66 Dy 162.5 Dysprosium	67 Ho 164.9 Holmium	68 Er 167.3 Erbium	69 Tm 168.9 Thulium	70 Yb 173.1 Ytterbium	71 Lu 175.0 Lutetium

Actinoids

89 Ac Actinium	90 Th 232.0 Thorium	91 Pa 231.0 Protactinium	92 U 238.0 Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium

Elements with atomic numbers 113 and above have been reported but not fully authenticated.

Standard atomic weights are abridged to four significant figures.

Elements with no reported values in the table have no stable nuclides.

The International Union of Pure and Applied Chemistry Periodic Table of the Elements (February 2010 version) is the principal source of data. Some data may have been modified.

Chemistry

DATA SHEET

Avogadro constant, N_A ..... 6.022×10^{23} mol^{-1}

Volume of 1 mole ideal gas: at 100 kPa and

at 0°C (273.15 K) ..... 22.71 L

at 25°C (298.15 K) ..... 24.79 L

Ionisation constant for water at 25°C (298.15 K), K_w ..... 1.0×10^{-14}

Specific heat capacity of water ..... 4.18×10^3 J kg^{-1} K^{-1}

Some useful formulae

$$\text{pH} = -\log_{10}[\text{H}^+] \qquad \Delta H = -m\,C\,\Delta T$$

Some standard potentials

$K^+ + e^-$	$\rightleftharpoons$	$K(s)$	–2.94 V
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	$Ba(s)$	–2.91 V
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	$Ca(s)$	–2.87 V
$Na^+ + e^-$	$\rightleftharpoons$	$Na(s)$	–2.71 V
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	$Mg(s)$	–2.36 V
$Al^{3+} + 3e^-$	$\rightleftharpoons$	$Al(s)$	–1.68 V
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	$Mn(s)$	–1.18 V
$H_2O + e^-$	$\rightleftharpoons$	$\frac{1}{2}H_2(g) + OH^-$	–0.83 V
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	$Zn(s)$	–0.76 V
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	$Fe(s)$	–0.44 V
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	$Ni(s)$	–0.24 V
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	$Sn(s)$	–0.14 V
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	$Pb(s)$	–0.13 V
$H^+ + e^-$	$\rightleftharpoons$	$\frac{1}{2}H_2(g)$	0.00 V
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(aq) + 2H_2O$	0.16 V
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	$Cu(s)$	0.34 V
$\frac{1}{2}O_2(g) + H_2O + 2e^-$	$\rightleftharpoons$	$2OH^-$	0.40 V
$Cu^+ + e^-$	$\rightleftharpoons$	$Cu(s)$	0.52 V
$\frac{1}{2}I_2(s) + e^-$	$\rightleftharpoons$	I^-	0.54 V
$\frac{1}{2}I_2(aq) + e^-$	$\rightleftharpoons$	I^-	0.62 V
$Fe^{3+} + e^-$	$\rightleftharpoons$	Fe^{2+}	0.77 V
$Ag^+ + e^-$	$\rightleftharpoons$	$Ag(s)$	0.80 V
$\frac{1}{2}Br_2(l) + e^-$	$\rightleftharpoons$	Br^-	1.08 V
$\frac{1}{2}Br_2(aq) + e^-$	$\rightleftharpoons$	Br^-	1.10 V
$\frac{1}{2}O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O	1.23 V
$\frac{1}{2}Cl_2(g) + e^-$	$\rightleftharpoons$	Cl^-	1.36 V
$\frac{1}{2}Cr_2O_7^{2-} + 7H^+ + 3e^-$	$\rightleftharpoons$	$Cr^{3+} + \frac{7}{2}H_2O$	1.36 V
$\frac{1}{2}Cl_2(aq) + e^-$	$\rightleftharpoons$	Cl^-	1.40 V
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	1.51 V
$\frac{1}{2}F_2(g) + e^-$	$\rightleftharpoons$	F^-	2.89 V

Aylward and Findlay, *SI Chemical Data* (5th Edition) is the principal source of data for this examination paper. Some data may have been modified for examination purposes.

Yr11 2012 Chem Yearly.

Marking Guidelines

Question 16a

Criteria	Marks
• Two alloys are identified • Appropriate uses are given for the alloys	2
• One alloy is identified and its use is given	1

Question 16b

Criteria	Marks
• Advanced technology leads to production of more types of metal and this allows that larger range of alloys can be produced. • More availability of alloys leads to more applications and demands for specific properties for particular applications increase.	2
• One alloy is identified and its use is given	1

Question 17

Criteria	Marks
• Water has a relatively high specific heat and hence it can absorb a great deal of heat and this will cause only a small temperature rise. • Water bodies such as oceans, lakes and rivers maintain a much more stable temperature than the surrounding atmosphere or land. • Water has a high thermal conductivity relative to other liquids; this quickly removes heat from a hot location to a cooler one. • Water is such a large component of the biosphere therefore it has a moderating influence on global temperatures, smoothing out the day to night and summer to winter fluctuations.	4
• Cover only three items of the above	3
• Cover only two items of the above	2
• Cover only one item of the above	1

Question 18a

Criteria	Marks
• Reactants: water and carbon dioxide • Products: glucose and oxygen	1

Question 18b

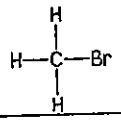
Criteria	Marks
• Photosynthesis is an endothermic process. • For each mole of glucose formed, 2803 kJ of energy is absorbed.	2
• Photosynthesis is identified as endothermic or • Energy is needed for producing each molecule of glucose.	1

Chemistry 11 Yearly Examination 2012 marking scheme Q 19 – 21

Q19

Criteria	Mark
Salt: 1.Ionic compound 2. Lattice breaks down because the cations attract to the negative end of polar water. Likewise to the anions. Ions become hydrated 3. Ion-dipole bond formed between ions and water molecule, thus salt dissolves. Sugar: 1. Polar covalent compound because of –OH group 2. Crystal of sugar breaks down because the positive area of sugar of the sugar molecules attract to the negative end of polar water. Likewise to the negative area of sugar molecules. The sugar molecules become hydrated. 3. Hydrogen bond formed between sugar molecules and water, thus sugar dissolves.	3
4 - 5 points of the above	2
2 – 3 points of the above	1
0 – 1 point of the above	0

Q20

Criteria	Mark
a) Methane	1
b) Must be in correct structure form of bromomethane 	1

Q21 (a) (i)

Criteria	Mark
Risks – must mention • Calcium - reactive • Hydrochloric acid - corrosive	1
Mention one of the above or mention zinc instead of calcium	0

Q21 (a) (ii)

Criteria	Mark
must mention wearing goggles plus one other reasonable precaution	1
only mention one precaution	0

Q21 (b)

Must be in table form and correct headings

Criteria		Mark
• Calcium + water • Calcium + dil HCl	must mention bubbles and the rate of forming must describe the formation of bubbles are faster than the reaction with water	2
• Zinc + water • Zinc + HCl	no visible change must mention bubbles and the rate of formation	
2 – 3 correct observations		1
no mention of bubbles or only 1 correct observation		0

Q21 (c)

Calcium + Hydrochloric acid ----------> Calcium chloride + Hydrogen

Q21 (d)

Criteria	Mark
$Ca_{(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + H_{2(g)}$	1
equation not balanced	0

Q22a

criteria	marks
• Explanation of graphite structure- Relate the property of softness to layered stucture AND • Explanation of diamond's structure • Relate diamond's structure to its hardness	2
Two of the above	1

ie weak forces between layers → sliding
3D covalent bonds → rigid

Q22b

criteria	marks
One use for diamond EG: drill tips, jewellery, etc	1

Q23a)

$Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \rightarrow PbI_{2(s)} + 2\ KNO_{3(aq)}$ (1 mark)

At this stage all students should know their formulae. This is obviously not the case. Students need to be able to answer such calculations as these readily, and if your performance was poor in question 23 you need to act know to improve your capabilities here.

Errors in earlier parts of Q23 were taken into account in subsequent sections.

23b)

Criteria	mark
• Moles of both Pb(NO3)2 • moles KI calculated • Statement correctly identifying limiting factor based on calculations.	2
• One of the above	1

Moles Pb(NO3)2 = 20.0/ (207.2 + 2x14.01+ 6x16.0) = 0.06038mol

Moles KI = 20.0/ (39.10 + 126.9) = 0.12048mol

From equation Pb(NO3)2 is in excess, and **limiting reactant is KI**

23c

Criteria	mark
• Moles PbI2 calculated • Mass PbI2 calculated, to 3 sig figs	2
• An omission from the above list	1

Sig figs marked in c)

½ mole KI used = moles PbI2 = 0.06024mol (If you identified KI as the limiting reactant then you must use the moles of KI to determine moles PbI2).

Moles PbI2 = 0.06024mol

Mass PbI2 = 0.06024mol x (207.2 + 2x126.9)g/mol = **27.8g (3 sig figs)**

(Must give 2 sig figs here.)

23d)

Criteria	mark
• Moles ~~KI~~ calculated • [KI] calculated using correct total volume	2
• One of the above	1

Moles KNO3 = 2 X 0.06024 = 0.12048mol

Total vol = 0.5L

[KNO3] =0 .12048mol/ 0.5L = **0.24mol/L**

23e)

$Pb^{2+}_{(aq)} + 2I^-_{(aq)} \rightarrow PbI_{2(s)}$ **(1 mark)**

Note on Q23(b) The explanation isn't super clear.

While the number of moles is less for Pb(NO3)2.
Twice as many moles of KI are used in the process.

If I had 0.12048 moles of KI, this would mean I need 0.06024 moles which is less than I have so I have more Pb(NO3)2 than I need.

On the other hand, if I had 0.06038 moles of Pb(NO3)2, I need 0.12076 moles which is more than I have. Hence KI is a limiting reagant.

Q24

Criteria	marks
* Between chlorine atoms within the molecule is a strong non-polar covalent bond. * Between chlorine molecules are weak dispersion forces. * The melting of chlorine requires breaking the bonds between chlorine molecules which are fairly weak and therefore explains the low melting point value.	3
Two of the above points.	2
One of the above points.	1

It is necessary to make it clear that melting involves breaking the bonds between chlorine molecules.

Q25

Criteria	marks
* Cohesion - water molecules are attracted to each other due to hydrogen bonding. * Surface tension - the uneven forces acting on water molecules at the surface result in an inward or downward pull of these water molecules. * The forces of cohesion and surface tension work together to give the water droplets a spherical shape.	2
One or two of the above	1

For the water droplet attached to the tap you need to mention cohesion, surface tension and adhesion.

Q26a Graph A

26b The more concentrated the acid the faster the rate of reaction.

Q26c

Criteria	marks
Three variables that need to be kept constant. - The volume of hydrochloric acid - The temperature of the acid. - The mass, shape and size of the magnesium pieces.	2
One or two of the above.	1

Using the term 'amount' is not specific enough to describe these variables.

Q26d To improve reliability it is necessary to repeat the experiment a number of times and average or compare results.

27

substance	example	use	property
Metallic	copper	Electrical wires	Conducts electricity ductile
Ionic	Sodium chloride	electrolyte	Ionises in water
Covalent	water	solvent	Polar Hydrogen bonding
Covalent network	Diamond (carbon)	drills	hard

28

1 mole = $-120 kJmol^{-1}$

0.01 mole = 1.2okJ =1200J 1 mark

$-1200 = -mc\,T$

$-1200 = -150 \times 4.18 \times (T_f - 18)$ 1 mark

$\Delta T = 1200/150 \times 4.18$

$= 1.9$

$T_f - 18 = 1.9$

$T_f = 19.9°C$ 1 mark

· Q29

a) Pb (equal sized cubes, Pb has the greatest density).

b) Since the change in temp is the same in all cases,
then q = m x C
for Cu: 3.49 ; Pb = 1.47; Fe = 3.54; Al = 2.43
Since q is largest for Fe it would lose the most energy when cooling down.

criteria	mark
• Evidence of calculation • State Fe loses most energy	2
• Either of above	1

c) All cubes of same dimensions. P has the smallest value of C. Loses smallest amount of energy → melts the smallest amount of ice.

criteria	mark
• Identifies Pb • Gives correct reason	2
• Either of above	1

(Has nothing to do with density as the metals are not immersed in a fluid.)

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criteria	mark
One metal, 2 methods of extraction Both processes described thoroughly Implications for both methods on the society	5
One metal, two methods of extraction Both processes described thoroughly Implication for only one method on the society OR One metal, two methods of extraction Only one process described thoroughly Implication for both methods on the society	4
One metal, one methods of extraction Only one process described thoroughly Implications for only one method on the society	3
One method and /or one process and/or one implication	2
One method listed or one process listed or one implication listed	1