Year 11 Half Yearly Answers, 2008

Part A: Answer grid for multiple choice questions.

					P Outcome(s)
1.	A O	B O	C ✓	D O	1
2.	A O	B O	C O	D ✓	4,5,11
3.	A ✓	B O	C O	D O	8
4.	A O	B O	C ✓	D O	7,8
5.	A O	B O	C O	D ✓	13
6.	A O	B O	C O	D ✓	13
7.	A O	B O	C ✓	D O	3
8.	A O	B ✓	C O	D O	6
9.	A O	B ✓	C O	D O	6
10.	A O	B ✓	C O	D O	13
11.	A ✓	B O	C O	D O	6
12.	A O	B O	C O	D ✓	6

Mark	

Part B. 37 marks
Attempt Questions 13 - 21
Allow about 55 minutes for this part
Show all relevant working in questions involving calculations.

Question 13 (4 marks**)**

A particularly keen JRAHS student obtained water samples from the *Dead Sea*, while holidaying in Jerusalem. He wanted to compare the percentage total salt of this seawater with that of his hometown's. Using school equipment he determined the percentage of total salt in his water sample. The result of his analysis is detailed below:

mass of evaporating basin = 253.3 g
mass of evaporating basin + seawater = 766.2 g
mass of salt residue = 165.0 g

(a) Calculate the percentage composition of the seawater sample. Show your working (3 marks)

Possible solution:

mass of seawater = mass of evaporating basin + seawater - mass of evaporating basin

= 766.2 – 253.3 = 512.9 g (1 mark)

$$\% \text{ salt} = \frac{165.0}{512.9} \times 100\,\% = 32.18\% \quad \textit{(1 mark)}$$

$$\% \text{ water} = \frac{512.9 - 165.0}{512.9} \times 100\,\% = 67.82\% \quad \textit{(1 mark)}$$

Marking Scheme

Criterion	*Mark(s)*
correct calculation for each of the three items:	1 each

(b) State one possible source of error for this determination. (1 mark)

A source of error would be the loss of salt by sputtering when the evaporating basin is heated.

P2 and P14

Question 14 (4 marks)

Metals and non-metals have uses which depend on their properties. Describe one use of copper metal and one of helium and justify their use(s) on the basis of their physical properties.

Possible Answer:

Pure copper is drawn into fine wires and used as a conductor in electrical connections. This use is possible because of the ability of copper to conduct electricity.

Helium gas is used as a filling for balloons. These balloons float on air and can be used to show messages. As the low density helium displaces an equivalent volume of air, buoyancy pushes the balloon up and allows it to float on air

Criterion	*Mark(s)*
Description of use for each substance with a justification of the use on the basis of physical property	4
Description of use for one substance with a justification of the use on the basis of physical property	3
Description of use for each substance with no justification of the use on the basis of physical property	2
Stating the use for two substances with justification	2
Stating the use for two substances no justification	1

Outcome: P4

Question 15 (6 marks)

Magnesium is a common element with known reactivity.

(a) Explain the valency and reactivity of magnesium in terms of its electronic configuration (3 marks)

Possible answer:

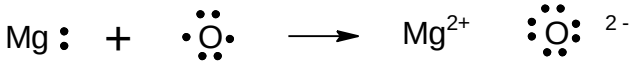
Magnesium has the following electronic configuration: 2.8.2. It has 2 electrons in the outermost shell and hence has a valency of 2 (1 mark).

Magnesium has a high reactivity because of the ease with which the 2 outermost electrons are lost. This loss results in an electronic configuration similar to neon. (1 mark)

Criterion	*Mark(s)*
electronic configuration:	1
explanation of valency and reactivity	2

(b) Use electron dot structures to illustrate the reaction of magnesium with the oxygen atom. (2 marks)

Possible answer:

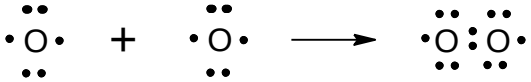


(2 marks)

Criterion	***Mark(s)***
correct electron dot structures for both Mg and O:	1
correct electron dot structure for MgO	1
use of "x" in place of dots will not be accepted	

(c) Draw the electron dot structure for the oxygen molecule: (1 mark)

Possible answer:



or

1 mark for the correct electron dot structure for oxygen.

Outcome:P6

Question 16 (3 marks)

Complete the table to illustrate the contrast between boiling and electrolysis of water in terms of physical & chemical change, breaking of a chemical bond or intermolecular forces and the magnitude of the energy requirement of the process

Possible answer

	Boiling	***Electrolysis***
Type of change (physical/chemical)	*physical*	*chemical*
Type of forces broken (chemical bond/ intermolecular forces)	*intermolecular forces only*	*both intermolecular forces and chemical bonds*
Magnitude of energy involved in the process (high/low)	*low*	*high*

Marking Guidelines

Criterion	*Mark(s)*
6 correct answers	3
5 correct answers	2
4 correct answers	2
3 correct answers	1
2 correct answers	0

Question 17 (4 marks)

A variety of chemical equations can be used to describe chemical reactions.

Possible answers

(a) Give a word equation for the chemical reaction that occurs when sulfur is strongly heated in air.(1 mark)

sulfur + oxygen → sulfur dioxide

(b) Give a balanced chemical equation for the reaction of sodium in water.(1 mark)

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

(c) Give the half equations for the reaction of iron metal in hydrochloric acid. (2 marks)

$Fe\ (s) \rightarrow Fe^{2+} + 2e$

$2H^+ + 2e \rightarrow H_2\ (g)$

1 mark for each correct equation. Subscripts *not* required. **Outcomes : P8, P10**

Question 18 (3 marks)

Metals have been extracted from their ores and used for many thousands of years.

(a) Give the formula for an ore from which copper is extracted. (1 mark)

possible answers

CuO, CuS, $CuCO_3$

(b) Explain why energy is necessary to extract a metal from its ore. (2 marks)

possible answer

Energy is required to break up the ore and separate the mineral from the rock mixture. It is also needed to break the chemical bonds and decompose the mineral to extract the metal.

Marking Criteria	Marks
• Explains the energy requirement for both physical and chemical separations	2
• Explains the energy requirement for either the physical OR the chemical separation.	1

Outcomes : P2 and P7

Question 19 (3 marks)

When Mendeleev published his Periodic Table, he predicted the existence of three elements not yet discovered, Ekaaluminium, Ekasilicon, and Ekaboron.

These elements, Gallium, Germanium and Scandium respectively, were subsequently discovered and found to have properties very similar to those he had predicted.

(a) What formulae do you think Mendeleev may have predicted for the oxides of Germanium and Gallium?(1 mark)

Ga_2O_3 GeO_2 (2 correct, 1 mark)

(b) On what basis did Mendeleev make these predictions?(2 marks)

These predictions were made on the basis that elements in the same group would have the same valency as well as having other physical and chemical properties in common.

Marking Criteria	Marks
• Same valency AND similar chemical and physical properties.	2
• Same valency OR similar properties.	1

Outcomes : P1, 2, 3

Question 20 (5 marks)

This question refers to the table below.

Substance	MP (^{0}C)	Electrical conductivity	
		Solid state	Liquid state
Q	-102	Nil	Nil
X	1423	Nil	Conducts
Y	3600	Nil	Nil
Z	1535	Conducts	Conducts

(a) Which substance is iron? Z (1)

(b) Which substance is calcium fluoride? X (1)

(c) Which substance is dinitrogen trioxide? Q (1)

(d) Which substance is diamond? Y (1)

(e) In substance B, identify the particles that carry the current in the liquid state ions

(f) In substance D, identify the particles that carry the current in the solid state electrons

e + f = (1)

Outcomes : P6

Question 21 (5 marks)

Chlorine is a reactive element in Group VII of the periodic table. Chlorine forms compounds with nearly all of the other elements. With oxygen, several such compounds are known, one of which is the heptoxide Cl_2O_7.

Possible answers

(a) Identify the trend in the reactivity of the elements in Group VII. (1 mark)

The activity of group VII elements decreases as atomic mass increases

(b) Explain the overall trend in the ionization energy of the elements in the period ending with chlorine.(3 marks)

The overall trend in ionization energy is that it increases from left to right across the periodic table i.e. from Na to Cl. As proton number in the nucleus increases the attraction for valence electrons also increases and therefore it requires more energy to remove an electron from the elements from left to right in the same period.

Marking Criteria	Marks
• Explains the need for higher energy requirements to remove an electron from left to right across the period	3
• Identifies an increasing trend in I_E from left to right across the period and • Identifies the increase in nuclear charge from left to right across the period	2
• Identifies an increasing trend in I_E from left to right across the period.	1

(c) Using your knowledge of valencies and the Periodic Table, predict the formula of another compound (other than Cl_2O_7) formed between chlorine and oxygen.(1 mark)

Cl_2O

Outcomes : P6

End of Test