Student Name: ……

Teacher: O'Donnell Hendriks McGrouther *(Circle the correct name.)*

Assessment Number: ……

2018

Year 11

Assessment Task 3 - Examination

Weighting ~~30%~~ 40%

CHEMISTRY

General Instructions

- Reading time – 5 minutes
- Working time - 2 hours
- Board approved calculators may be used
- Write using blue or black pen
- Draw diagrams using pencil
- A data sheet and a Periodic Table are provided
- Write your student number and/or name at the top of every page

Total marks - 75

Attempt ALL questions

Section I
20 marks
Attempt Question 1-20
Allow about 35 minutes for this section

Section II
55 marks
Attempt Questions 21-33
Allow about 1 hour 25 minutes for this section

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Section 1 (20 marks)

Attempt questions 1 – 20

Allow 35 minutes for this section.
Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) on the Multiple Choice Answer sheet provided.

1. Which of the following is a chemical property of the element magnesium?

   (A) It is more dense than water.

   (B) It is a solid at room temperature with a hexagonal crystal structure.

   (C) It is an excellent electrical conductor.

   (D) When ignited it combusts in the presence of oxygen.

2. Which of the following substances contains only covalent bonds.

   (A) MgO

   (B) NH_4NO_3

   (C) CO_2

   (D) NaCl

3. The general reaction A +B → C + D is given as exothermic.

   Which is the correct comparison of the enthalpy of the reactants and products?

   (A) They are the same

   (B) They are both equal to zero

   (C) The products have a higher enthalpy than the reactants

   (D) The reactants have a higher enthalpy than the products

4. A chemical reaction occurs in a glass flask. The flask gets colder as the reaction proceeds.

   Which is a correct inference from this observation?

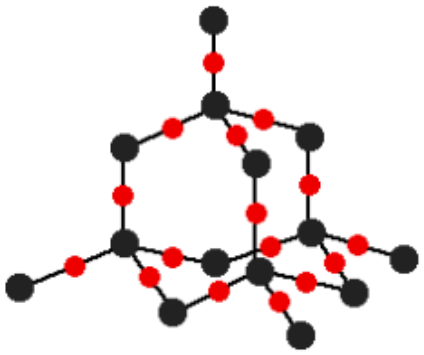
   (A) The flask was very cold to start with.

   (B) The reaction was exothermic.

   (C) The reaction was endothermic

   (D) The reaction required a catalyst for the process to start.

5. The diagram below is a representation of silicon dioxide. The small balls represent oxygen and the large balls represent silicon. The chemical bonds between the atoms are shown as lines.



Which row in the table below correctly describes the lines in the diagram?

	Number of electrons in each line	*Type of chemical bonding*
(A)	One	Covalent
(B)	One	Ionic
(C)	Two	Covalent
(D)	Two	Ionic

6. What percentage, by mass, of sodium acetate ($NaCH_3COO$) is carbon?

(A) 14.6%

(B) 17.2%.

(C) 24.3%

(D) 29.3%

7. How many oxygen atoms are present in a 10.0 g sample of CO_2 gas?

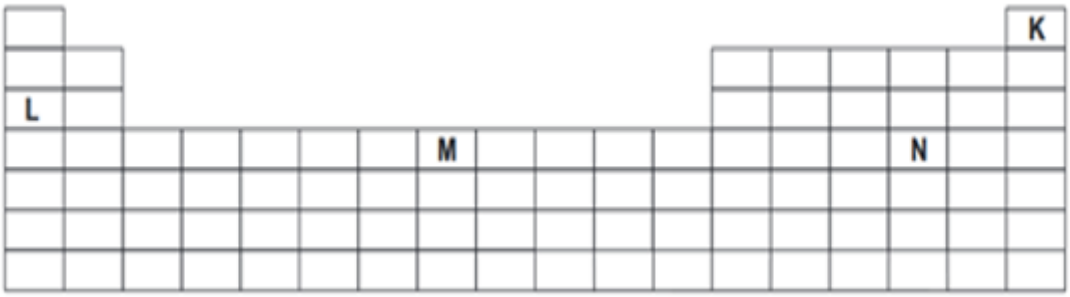
(A) 1.37×10^{23}

(B) 2.74×10^{23}

(C) 4.10×10^{23}

(D) 6.02×10^{23}

8. The positions of four elements are shown on this periodic table.



Which alternative below correctly matches the elements with the block to which they belong in the periodic table?

	L	**M**	**N**	**K**
(A)	s	p	d	s
(B)	s	d	p	s
(C)	d	s	d	p
(D)	d	s	p	p

9. A water sample was analysed and found to contain 0.063 g of lead per 100 mL of solution.

Which of the following is an equivalent concentration in parts per million?

(A) 0.063 ppm

(B) 0.63 ppm

(C) 63 ppm

(D) 630 ppm

10. A reaction between hydrogen and oxygen is written as:

$$H_2(g) + \tfrac{1}{2}O_2(g) \rightarrow H_2O(l) \qquad \Delta H = -286 \text{ kJ}$$

What is the enthalpy change for the reaction $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$?

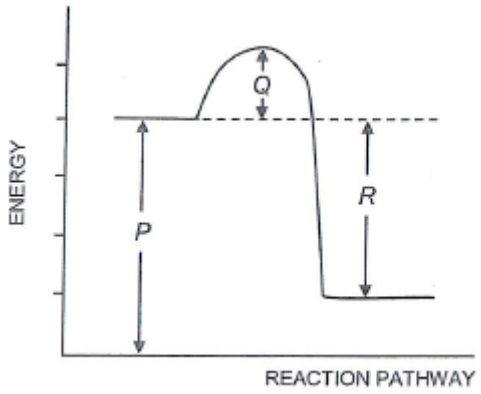
(A) -143 kJ

(B) -286 kJ

(C) + 286 kJ

(D) -572 kJ

11. An energy profile diagram for a chemical reaction is shown below.



What is the correct description of this reaction?

(A) An exothermic reaction with Q indicating activation energy

(B) An exothermic reaction with R indicating activation energy

(C) An endothermic reaction with Q indicating activation energy

(D) An endothermic reaction with R indicating activation energy

12. Using the data below, identify the most reactive metal?

Metal	*Ionisation Energy (kJ/mol)*	*Electronegativity*
P	495.7	0.93
Q	737.8	1.31
R	745.48	1.90
S	890.1	2.54

(A) P

(B) Q

(C) R

(D) S

13. Which of the following is a non-polar linear molecule?

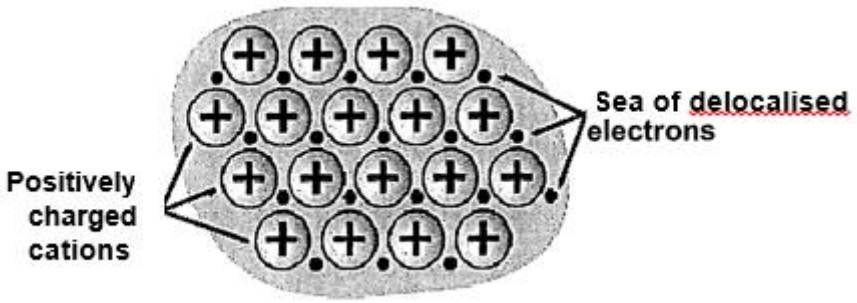
(A) CO

(B) CO_2

(C) CH_4

(D) H_2O

14. The structure of many chemicals can be represented by bonding models.



What bonding model is represented by this diagram?

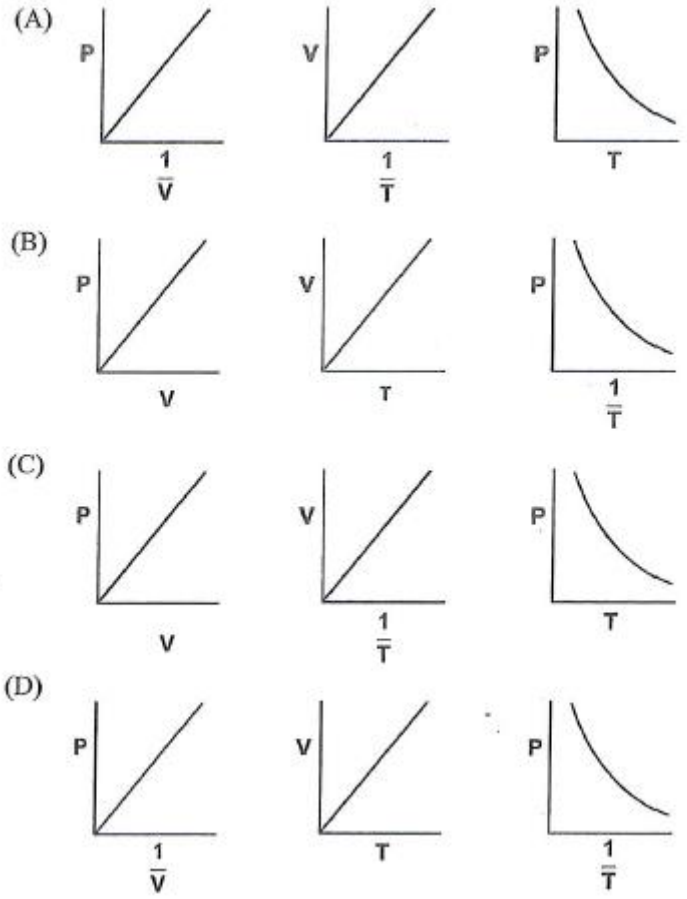
(A) ionic

(B) metallic

(C) covalent network

(D) covalent molecular

15. Which of the following sets of graphs shows the correct relationships between the pressure (P), volume (V) and temperature (T) of a gas sample?



16. Pure iron can be made in a blast furnace. Iron ore is mixed with coke (carbon) and limestone.

The chemical equation for the reaction is shown below:

$$3C + 2Fe_2O_3 \rightarrow 4Fe + 3CO_2$$

Which of the following statements is correct?

(A) Carbon changes from oxidation number 0 to +2. Carbon is oxidised.

(B) Iron changes from oxidation number +3 to 0. Iron is reduced.

(C) Carbon changes from oxidation number 0 to -4. Carbon is reduced.

(D) Iron changes from oxidation number +2 to +4. Iron is oxidised.

17. Use the specific heat capacity of substances A and B in the table below to answer this question.

Substance	Specific heat capacity ($Jg^{-1}K^{-1}$)
A	2.121
B	1.433

From the data provided, if 100kJ of heat energy were added to 1.0g samples of A and B, which of the following statements would be true?

(A) The temperature of B will increase more than that of A

(B) The temperature of A will increase more than that of B.

(C) The amount of heat absorbed by A will be greater than B.

(D) The amount of heat absorbed by B will be greater than A.

18. Which of the alternatives below identifies the electron configuration of the cation and anion present in the compound aluminum chloride?

	Cation	**Anion**
(A)	$1s^2 2s^2 2p^6 3s^2 3p^1$	$1s^2 2s^2 2p^6 3s^2 3p^5$
(B)	$1s^2 2s^2 2p^6 3s^2 3p^5$	$1s^2 2s^2 2p^6 3s^2 3p^1$
(C)	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6 3s^2 3p^6$
(D)	$1s^2 2s^2 2p^6 3s^2 3p^6$	$1s^2 2s^2 2p^6$

19. Americium-241 undergoes alpha decay to produce isotope Y.

What is isotope Y?

(A) Curium-241

(B) Lead-208

(C) Neptunium-237

(D) Plutonium-240

20. When a person dives into the ocean, the pressure of gas in their lungs changes from 100kPa to 160kPa.

If their lungs held 6.0L of gas, what volume of gas will be present in the lungs at the increased pressure?

(Assume the temperature of the gas in the lungs remains constant.)

(A) 3.0L

(B) 3.8L

(C) 4.5L

(D) 6.0L

Section II Assessment Number: ……..

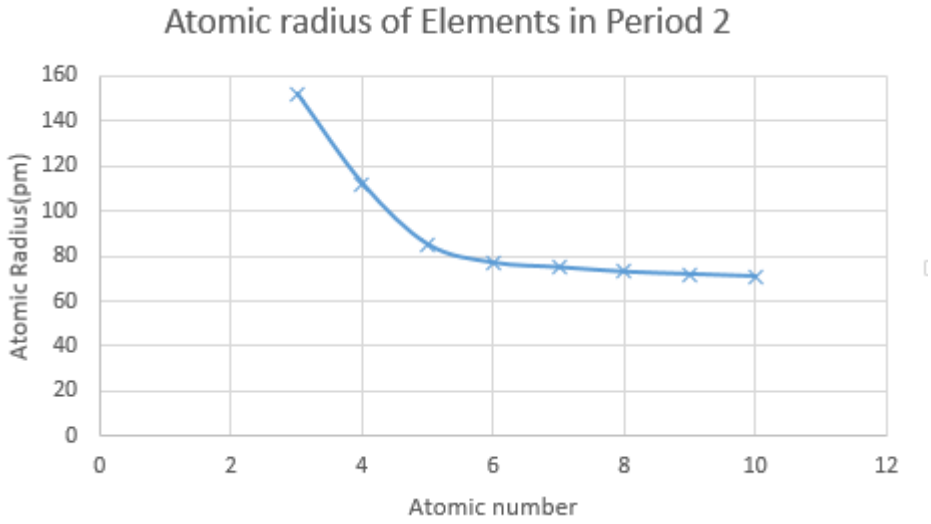
55 marks
Attempt Questions 21-32
Allow about 1 hour and 25 minutes for this section

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Question 21 (3 marks)

A student collected information on the atomic radius, measured in picometers (pm), of the elements in period 2 and created the following graph.



Identify and explain the general trend shown by the graph. (3 marks)

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Question 22 (10 marks)

(a) Phosphorus-31 is an isotope of phosphorus.

Complete the following table to indicate the number of protons, neutrons and electrons in an atom of phosphorus-31. (1 mark)

Protons	Neutrons	Electrons

(b) What is the spdf notation for a phosphorus atom? (1 mark)

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(c) PCl_3 is a chloride of phosphorus.

i) What is the systematic name of PCl_3? (1 mark)

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ii) Draw the Lewis dot diagram for PCl_3. (1 mark)

iii) What is the molecular shape of PCl_3? (1 mark)

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iv) The reaction to form liquid PCl_3 involves heating solid phosphorus, in the form of P_4, with chlorine gas.

Write a balanced chemical equation for this reaction. (2 marks)

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v) PCl_3 has a relatively low boiling point and cannot conduct electricity. Explain why. (3 marks)

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Question 23 (4 marks)

1.28 g of zinc metal reacts with 200.0 mL of 0.10 mol L^{-1} hydrochloric acid according to the following equation.

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

(a) Calculate the volume of hydrogen gas produced (measured at 100 kPa and 25°C). (3 marks)

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(b) Write the oxidation half-equation for this reaction.(1 mark)

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Question 24 (2 Marks)

A cylinder holds 6.0g of nitrogen gas at a temperature of 20^{o}C and pressure of 150kPa.
Determine the volume of the cylinder. Show your working. (2 marks)

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Question 25 (2 marks)

Use the solubility table to determine if a precipitate forms when the following solutions are mixed.
If a precipitate forms write a net ionic equation for the reaction. If no precipitate forms write "no precipitate."
(2 marks)

Soluble Compounds	Insoluble Exceptions
Group 1 metals and NH_4^+	
Nitrates (NO_3^-) and acetates (CH_3COO^-)	
Chlorides (Cl), bromides (Br^-) and iodides (I^-)	Ag^+, Pb^{2+} and Hg^+
Sulfates (SO_4^{2-})	Ag^+, Pb^{2+}, Hg^+, Ba^{2+}, Sr^{2+} and Ca^{2+}
Insoluble Compounds	**Soluble Exceptions**
Carbonates (CO_3^{2-}), sulfites (SO_2^{2-}) and phosphates (PO_4^{3-})	Group 1 metals and NH_4^+
Hydroxides (OH^-)	Group 1 metals, NH_4^+, Ca^{2+} and Ba^{2+}
Sulfides (S^{2-})	Group 1 and 2 metals and NH_4^+
Oxides (O^{2-})	Group 1 metals, NH_4^+, Ca^{2+} and Ba^{2+}

(a) barium nitrate and copper sulfate (1 mark)

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(b) barium chloride and sodium hydroxide (1 mark)

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Assessment Number: …….

Question 26 (5 marks)

(a) Describe how a 250.0 mL volume of a 0.0500 mol L^{-1} standard solution of copper sulfate could be produced using dry, solid copper sulfate ($CuSO_4$). (4 marks)

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(b) Determine the volume of the original 0.0500 mol L^{-1} standard solution of copper sulfate required to make 250.0mL of 0.00400molL^{-1} (1 mark)

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Question 27 (7 marks)

Consider the following redox pairs and their **reduction** potentials (E^o values)

Zr^{4+}	+	$4e^-$	→	$Zr(s)$	-1.53V
Ga^{3+}	+	$3e^-$	→	$Ga(s)$	-0.53V
Au^+	+	e^-	→	$Au(s)$	+1.68V
Pt^{2+}	+	$2e^-$	→	$Pt(s)$	+1.20V

(a) Identify the species which is the:

(i) strongest oxidising agent ……. (1 mark)

(ii) strongest reductant ……..…….. (1 mark)

(b) A student was required to conduct an investigation to determine the reduction potential of the V^{2+}/V half cell.

Describe a valid procedure the students could follow to carry out this investigation. Include a labelled diagram in your answer. Space has been provided for the diagram on the next page. (5 marks)

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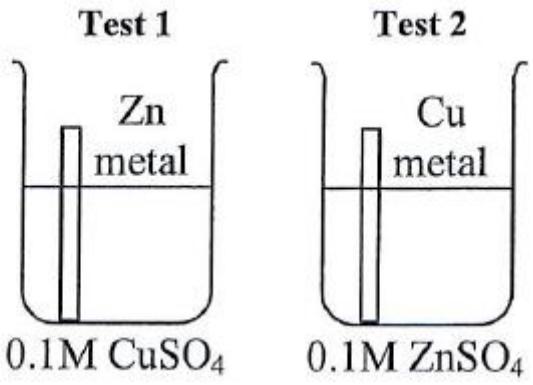
There is space over the page for a diagram.

Diagram

Question 28 (4 marks)

A student carried out an investigation involving metals and solutions of metal ions.



(Copper sulfate solution is a blue colour and zinc sulfate solution is colourless.)

(a) Identify and explain any observable changes in Test 1. (2 marks)

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(b) Identify and explain any observable changes in Test 2. (2 marks)

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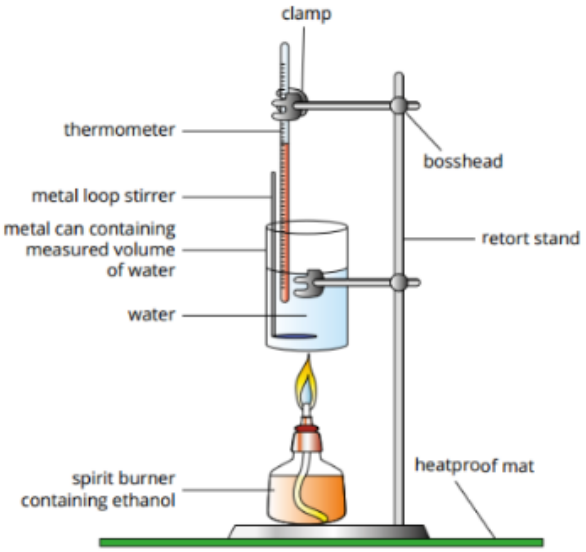
Question 29 (8 marks)

The following apparatus was set up to determine the molar heat of combustion of ethanol, C_2H_5OH.



During the investigation the following data were collected.

Mass of water	100.00g
Initial mass of spirit burned	24.65g
Final mass of spirit burner	23.83g
Initial temperature of water	22°C
Maximum temperature reached in the water	63°C

(a) Use the above data to calculate the experimental molar heat of combustion for ethanol. (4 marks)

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(b) The published molar heat of combustion of ethanol is 1367kJ/mol.

i) Assess the accuracy of the experimental result calculated in (a). (1 mark)

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ii) Discuss the validity of the method used in this investigation. (3 marks)

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Question 30 (4 marks)

Using carbon as an example, distinguish between the terms allotrope and isotope. (4 marks)

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Question 31 (2 marks)

Use the bond energies provided to calculate the enthalpy change for the following reaction. Show all working. (2 marks)

$$H_2(g) + Br_2(g) \rightarrow 2HBr\ (g)$$

Average Bond Energies (kJ/mol)

Single bonds								Multiple bonds	
C–H	414	Si–O	466	H–I	298	Cl–F	255	C=C	614
C–C	346	N–H	391	O–H	463	Cl–Cl	242	C≡C	839
C–N	286	N–C	286	O–O	144	Br–F	249	C=N	615
C–O	358	N–N	158	O–F	191	Br–Cl	219	C≡N	890
C–F	492	N–O	214	O–Cl	206	Br–Br	193	C=O	804
C–Cl	324	N–F	278	O–I	201	I–Cl	211	N=N	470
C–Br	285	N–Cl	192	S–H	364	I–Br	178	N≡N	945
C–I	228	N–Br	243	S–F	327	I–I	151	O=O	498
C–S	289	H–H	436	S–Cl	271			S=O	523
Si–H	323	H–F	567	S–Br	218			S=S	429
Si–Si	226	H–Cl	431	S–S	266				
Si–C	307	H–Br	366	F–F	159				

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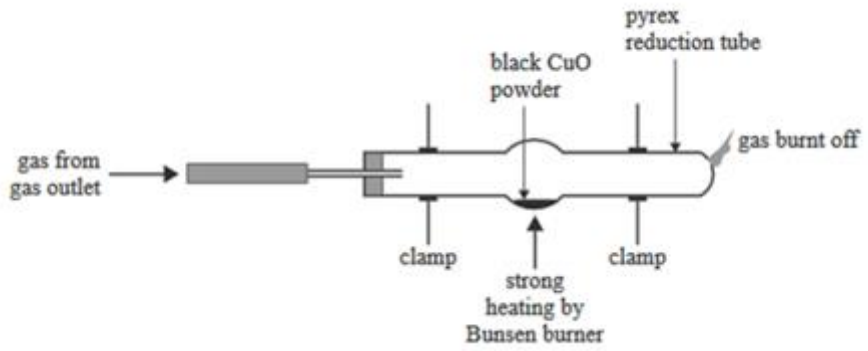
Question 32(4 marks)

A student used the following apparatus to decompose a small sample of an oxide of copper. The products of the decomposition are metallic copper and oxygen. The oxygen produced leaves the reacting vessel.



The data from the experiment are shown below.

Mass of empty test tube (g)	30.48
Mass of test tube and copper oxide powder before heating (g)	32.73
Mass of test tube and residue after heating for 1 minute (g)	32.58
Mass of test tube and residue after heating for 2 minute (g)	32.34
Mass of test tube and residue after heating for 3 minute (g)	32.28
Mass of test tube and residue after heating for 4 minute (g)	32.28

(a) Use the data provided to determine the empirical formula of the oxide decomposed in the investigation. (3 marks)

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(b) Why was the mass of the test tube and residue measured after each minute of heating.(1 mark)

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End of paper

2018

Year 11 Assessment Task 3

Weighting 35%

CHEMISTRY MARKING GUIDELINES

Section I (20 marks)

1.	D	11.	A
2.	C	12.	A
3.	D	13.	B
4.	C	14.	B
5.	C	15.	D
6.	D	16.	B
7.	B	17.	A
8.	B	18.	C
9.	D	19.	C
10.	D	20.	B

Section II

Question 21

Criteria	Mark
• Correctly identifies trend shown in the graph and provides a thorough explanation that refers to number of protons, number of electron and number of electron shells and increased attraction between the nucleus and the electron shells.	**3**
• Correctly identifies the trend shown in the graph and provides a partial explanation for the trend	**2**
• Correctly identifies the trend shown in the graph OR • Provides a partial explanation for the trend shown in the graph	**1**

Sample Answer: The trend shown in the graph is that as atomic number increases across period 2, the atomic radius decreases. As the atomic number increases across period 2, the number of protons in the nucleus increases and the number of electrons increases but the number of electron shells remains the same. This increases the core charge of the atom and causes a greater electrostatic attraction between the electrons and the nucleus. This attraction 'pulls' the electrons valence shell closer to the nucleus, reducing the atomic radius of the atom.

Marker's comments: All students could identify the trend and most showed an understanding that the atomic radius get smaller as the electrons become more attracted to the nucleus. Better answers provided a thorough explanation as to why this attraction increased by referring to number of protons, electrons and electron shells.

Question 22(a)

Criteria	Mark
Correct number of protons, neutrons and electrons are provided	1

Sample answer: Protons 15, Neutrons 16 and electrons 15.

Marker's comments: Well done. If you did not receive this mark, please discuss with your teacher.

Question 22(b)

Criteria	Mark
Correct answer	1

Sample answer: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

Marker's comments: Well done.

Question 22(c) (i)

Criteria	Mark
Correct answer	1

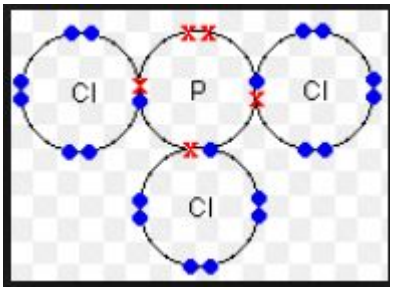
Sample answer: phosphorus trichloride

Marker's comments: Generally well done. Naming conventions are important in chemistry and do need to be learnt.

Question 22(c) (ii)

Criteria	Mark
Correct answer	1

Sample answer:



Marker's comments: This was reasonably well answered. A few students did not show all valence electrons. This is a requirement of a Lewis dot diagram. Some students drew phosphide and chloride ions, thinking the compound was ionic.

Question 22(c) (ii)

Criteria	Mark
Correct answer	1

Sample answer: pyramidal/trigonal pyramid

Marker's comments: This was not well answered. Shapes of molecules should be reviewed.

Question 22(c) (iv)

Criteria	Mark
Correctly balanced equation with states	2
One of the above	1

Sample answer: $P_4(s) + 6Cl_2(g) \rightarrow 4PCl_3(l)$

Marker's comments: This was not done as well as it should have been. A large number of students did not remember that chlorine gas is a diatomic molecule so its formula is Cl_2. A few students did not include states or wrote the incorrect state. It is important to always include states for balanced equations and to read provided information carefully to determine these states.

Question 22(c) (v)

Criteria	Mark
Answer includes a complete and correct explanation of the low boiling point and lack of conductivity that refers to structure and bonding of PCl3 and shows a clear understanding of conductivity and the processes involved in boiling a covalent molecular substance.	3
as above with minor error or omission	2
Attempts to explain the low boiling point or the lack of conductivity.	1

Sample answer: For a substance to conduct electricity it must contain mobile charged species. PCl_3 exists as a molecule and contains no mobile charged species so cannot conduct electricity. (all electrons are localised and the molecule does not contain any ions that could become mobile). While strong covalent bonds, hold the atoms in the molecule together, weak intermolecular forces (dipole-dipole and dispersion) exist between neighbouring molecules. When a covalent molecular substance is boiled, it is the intermolecular forces that break. As these are weak, only a relatively small amount of energy is required to break them, giving rise to a low boiling point.

Marker's comments: Most students showed a clear understanding of why PCl_3 has a low boiling point and cannot conduct electricity however did not include sufficient details in their answer. This was particularly true for the explanation of conductivity. It is important that your answer reflects an understanding that it is any mobile charge that can create conductivity. Most answers only focused on the fact that PCl_3 has no mobile electrons.
Some students did not show a clear understanding of where intermolecular forces act. This should be reviewed.

Question 23 (a)

Criteria	Mark
Limiting reagent is correctly identified; correct answer is calculated and recorded to the correct number of significant figures.	3
Two of the above	2
One correct and relevant calculation is performed	1

Sample answer:

n_{Zn} = m/MM
= 1.28g/65.38g/mol
=0.01957..mol

n_{HCl} = C x V
= 0.10 mol/L x 0.2000 L
= 0.020 mol

For complete consumption of Zn and HCl required mole ratio is Zn:HCl 1:2,
Have a ratio of 0.01957:0.02 = approximately 1:1. Therefore there is not enough moles of HCl to completely react with the moles of Zn, therefore HCl is the limiting reagent. (moles of HCl must be used to determine moles of H_2 produced)

HCl: H_2
2:1
n_{H2} = ½ x nHCl
= ½ x 0.020 mol
= 0.010 mol
V_{H2}=n x Vm
= 0.010 mol x 24.79 L/mol
= 0.2479 L
= 0.25 L (to 2 sig fig)

(Can also use PV=nRT to determine volume of H_2)

Marker's comments: This was done very well by some students and very poorly by others. Students that found this difficult are encouraged to seek help from their teacher and complete practice questions.

Question 23 (b)

Criteria	Mark
Correct answer	1

Sample answer: $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$

Marker's comments: Once again this was done well by a number of students but poorly by others. A few students wrote the reduction instead of the oxidation equation and other have trouble balancing the charges.

Question 24

Criteria	Mark
Correct answer including units and working shown	**2**
One of the above	**1**

Sample answer:
PV=nRT
V=nRT/P

n_{N2} = m/mm
= 6.0g/14.01x2 g/mol
= 0.2141327623
T in K = T°C + 273.15 (273 is acceptable)
= 20 + 273.15
= 293.15K
V= 0.214… x 8.314 x 293.15/150
= 3.479299215 L
= 3.5 L (to 2 sig fig)

Marker's comments: Well done. Some students did not know the value for R. This can be found on the datasheet. It is also important to remember that temperature must be entered in Kelvin, pressure as kPa and the volume unit will be L. Markers were not deducted for sig fig for this question but it is important to always ensure answers are recorded to the correct number of sig fig.

Question 25 (a)

Criteria	Mark
Correct answer	**1**

Sample Answer: ppt will form
net ionic equation: $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$

Marker's comments: Most students could conclude that a ppt would form however not all of these could write the net ionic equation. Review of writing net ionic equations is required for these students.

Question 25 (b)

Criteria	Mark
Correct answer	**1**

Sample Answer: no ppt

Marker's comments: Well done.

Question 26(a)

Criteria	Mark
• Correctly determines the mass of solid required • Describes the method for producing a primary standard solution including a volumetric flask **(V),** deionised water **(DW)**, dissolving the solid **(D)**, rinsing the beaker **(R)** and inverting the flask **(I)**	**4**
• Correctly determines the mass of solid required • Demonstrates a satisfactory understanding of the method	**3**
• Calculates the mass OR describes most of the above features in the method OR demonstrates a sound understanding of the calculation and identifies some features of the method	**2**
• Calculates with an error OR describes two of the features of the method	**1**

Model Response:

$n(CuSO_4) = cV$ 1 1

$= 0.0500 \text{ mol } L^{-1} \times 0.2500 \text{ L}$

$= 0.0125 \text{ mol}$

$n = m/MM$

$m(CuSO_4) = n \times MM = 0.0125 \text{ mol} \times 159.62 \text{ g/mol}$

$= 2.00 \text{g}$ (3 sig fig)

2.00 g of dry, solid $CuSO_4$ is weighed on an electronic balance in a small beaker. A small amount of distilled water is added to dissolve all the solid. The solution is transferred to a clean 250.0mL volumetric flask previously rinsed with distilled water. More distilled water is added to make up the final total volume of 250.0mL. A stopper is placed on the flask and the flask is inverted a three times to mix the solution thoroughly.

Marker's Feedback: Incorrect numbers of significant figures were not marked but the mass should have had 3 sig fig. Many students omitted key features of the method.

Question 26(b)

Criteria	Mark
• Correctly determines the volume of standard solution required	**1**

Model Response:

$c_1V_1 = c_2V_2$

$0.0500 \text{molL}^{-1} \times V_1 = 0.00400 \text{molL}^{-1} \times 0.2500 \text{L}$

$V_1 = 0.00400 \text{molL}^{-1} \times 0.2500 \text{L} / 0.0500 \text{molL}^{-1}$

$= 0.0200 \text{L}$

$= 20.0 \text{mL}$ (3 sig fig)

Marker's Feedback: Some students need to review this type of calculation and the formula. Once again, many students included the wrong number of significant figures.

Question 27
(a)

(i) Identifies the strongest oxidising agent as Au^{+} (1 mark)
(ii) Identifies the strongest reductant as Zr (1 mark)

Marker's Feedback: Many students struggled to identify these species, especially (i). Students must review and practise applying these terms.

(b)
Written Method - 3 marks

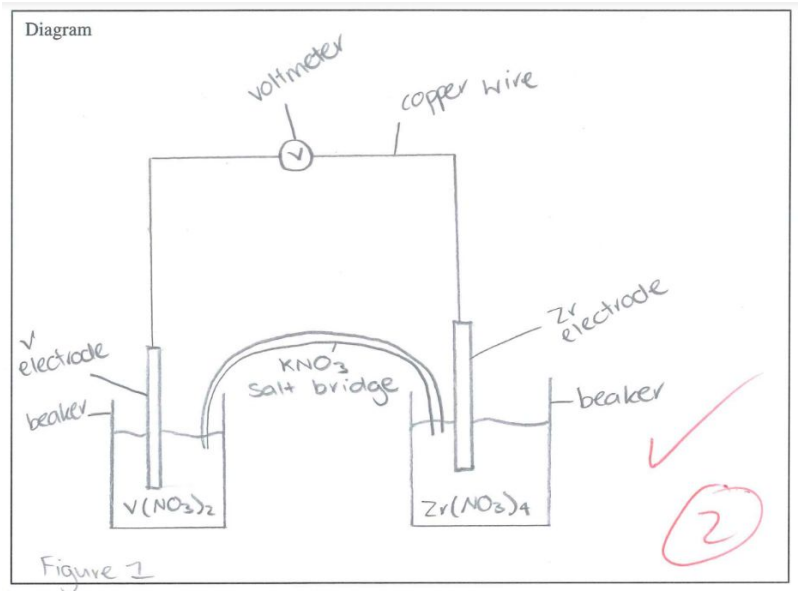
Criteria	Mark
Describes a procedure that achieves the following • constructs a V^{2+}/V half cell • connects to a second half cell • uses a wire, salt bridge and voltmeter • describe how to calculate the cell potential using $E^{o}_{total} - E^{o}_{ox}$ OR $-E^{o}_{total} - E^{o}_{ox}$ • identifies that standard conditions should be used (1.0 $molL^{-1}$, 25°C, 100kPa), clean metal electrodes	**3**
Describes a procedure that achieves some of the above but more than the simple comparison below.	**2**
Describes a procedure that compares two half cells, one of which is a V^{2+}/V half cell	**1**

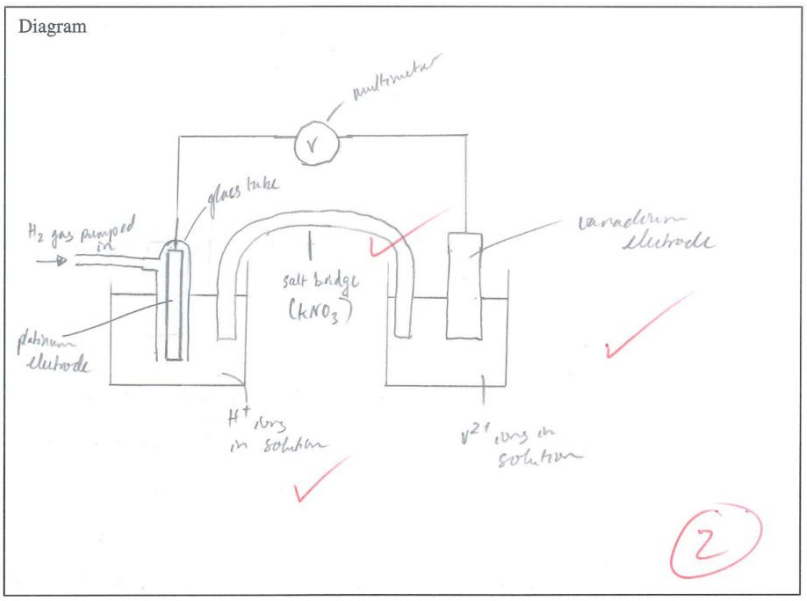
Marker's Feedback: This question required an excellent knowledge of galvanic cells and attention to detail. Many students demonstrated a good general understanding of the construction of galvanic cells but omitted vital details.

Diagram of the Method - 2 marks

Criteria	Mark
Draws a labelled, functional cell that agrees with the method	**2**
Draws a diagram that indicates an understanding of galvanic cell construction	**1**

Model Responses:





Marker's Feedback: Students generally demonstrated a good understanding but many omitted a key feature of the cell. Once again, attention to detail is important.

Question 28

(a)

Criteria	Mark
• Identifies the appearance of brown/orange/pink solid layer on the zinc metal • Identifies that the blue colour of the solution fades or becomes colourless • Explains the changes by stating that zinc is a more reactive metal than copper	**2**
• Achieves one of the above	**1**

Model Responses: The zinc metal will develop a brown/orange solid coating and the blue solution will become less blue. These changes occur because zinc is a more reactive metal than copper. Zinc is a stronger reductant than copper so each zinc atom will therefore be oxidised, losing 2 electrons to each copper ion. The zinc ions will go into solution and the solid copper atoms will plate onto the zinc metal. Fewer copper ions will result in less blue colour in the solution.

Marker's Feedback: Most students could describe the changes although some responses lacked detail and or clarity. Students are encouraged to write simple, clear answers. Note that an observable change is something that can be seen etc. Many students wrote that copper would appear on the zinc; this is a conclusion as the identity of the brown substance can only be inferred. Some students wrote really thorough explanations, demonstrating an excellent understanding of redox and the terminology.

(b)

Criteria	Mark
• Identifies that no change will occur • Explains by stating that copper is a less reactive metal than zinc	**2**
• Achieves one of the above	**1**

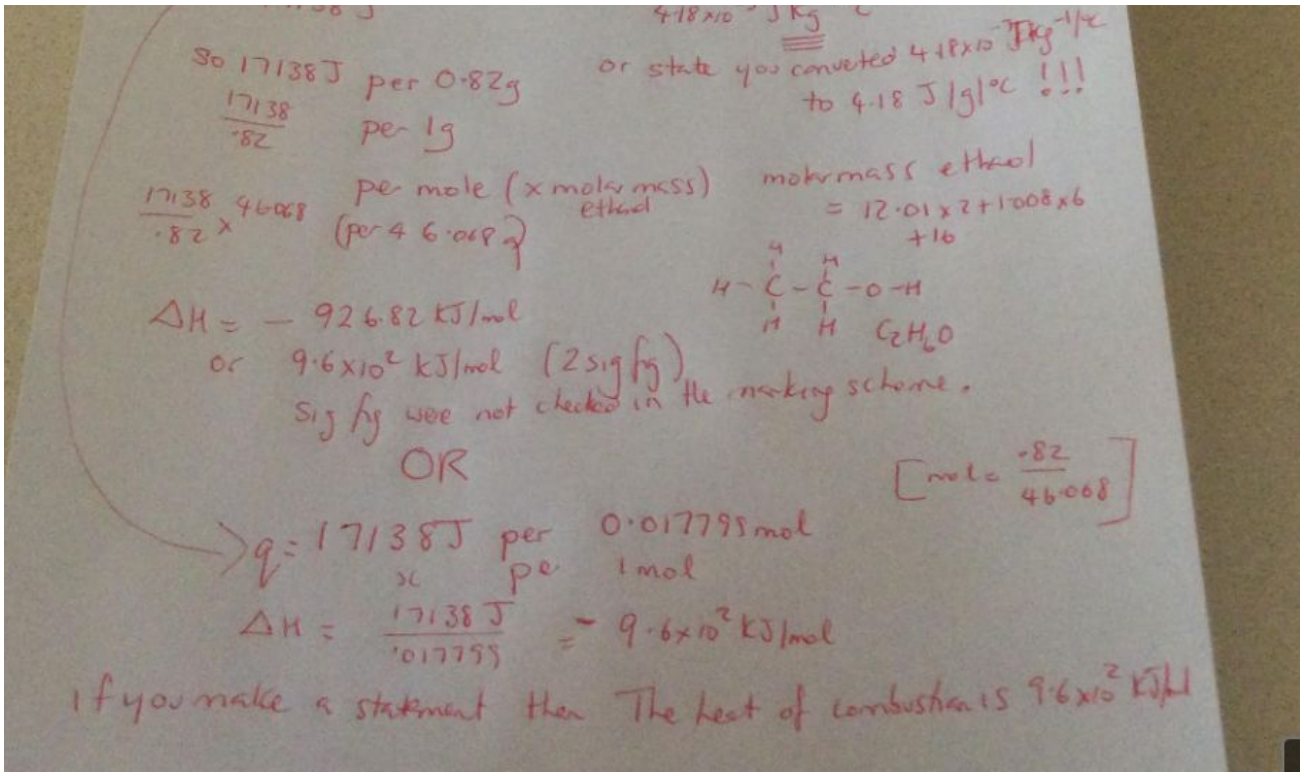
Model Responses: There will be no observable changes as copper is a less reactive metal than zinc. Copper is a weaker reductant than zinc and will not lose electrons to zinc ions.

Marker's Feedback: See above.

Question 29 (a)

Criteria	Mark
• Correct answer, correct sign and correct working and correct units	4
• Minor error	**3**
• Correctly calculates q or has several errors in calculation	**2**
• Makes a correct calculation for one of the steps needed to calculate the molar heat of combustion	**1**

Model Response:



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Marker's Feedback: Not well done many had incorrect units, incorrect sign which is most important, incorrect sig fig although this was not marked as incorrect.

Question 29 (b)(i)

1 mark correct answer

Model Response:

The result was not accurate as it does not agree with the published result.

Marker's Feedback: A few people who had no answer in (a) were able to gain a mark by explaining the term accuracy correctly with a fake result showing good exam technique. It was not good enough to just say it was inaccurate you needed to say why to get the mark. Interestingly some worked out the % error which should be True value – Experimental / true value x 100

Question 29(b)(ii)

Criteria	Mark
• Correctly discusses the validity in terms of not valid due to heat loss AND includes lack of repetition .(A valid method is accurate and reliable, reliability cannot be assessed as there was no repetition) or discusses equipment correctly	3
• Correctly discusses the validity in terms of not valid due to heat loss only	2
• Makes a correct statement	1

Model Response:
A method is VALID if:

- the measurements are actually measuring what you intend them to measure
- it incorporates suitable equipment, controlled variables, appropriate measuring procedures etc
- the experiment is accurate and reliable

This experiment is not valid as the measurements did not measure the molar heat of combustion, the assumption made was that all the heat from the burner was transferred to the water this was not correct as heat was lost to the surroundings. This produced inaccurate results. The equipment used was accurate although a data logger and temperature probe may produce more accurate results. The experiment was not repeated so reliability could not be assessed.

Marker's Feedback: Most students scored only 2 marks as they did not consider the equipment or reliability. Also another assumption that no one mentioned was that there was complete combustion. Perhaps there was not complete combustion and some CO was produced.

Question 30

Criteria	**Mark**
Correctly defined allotrope and isotope to distinguish between them and had 2 examples of each term	4
One part incorrect	**3**
Two parts incorrect/missing	**2**
One correct statement	**1**

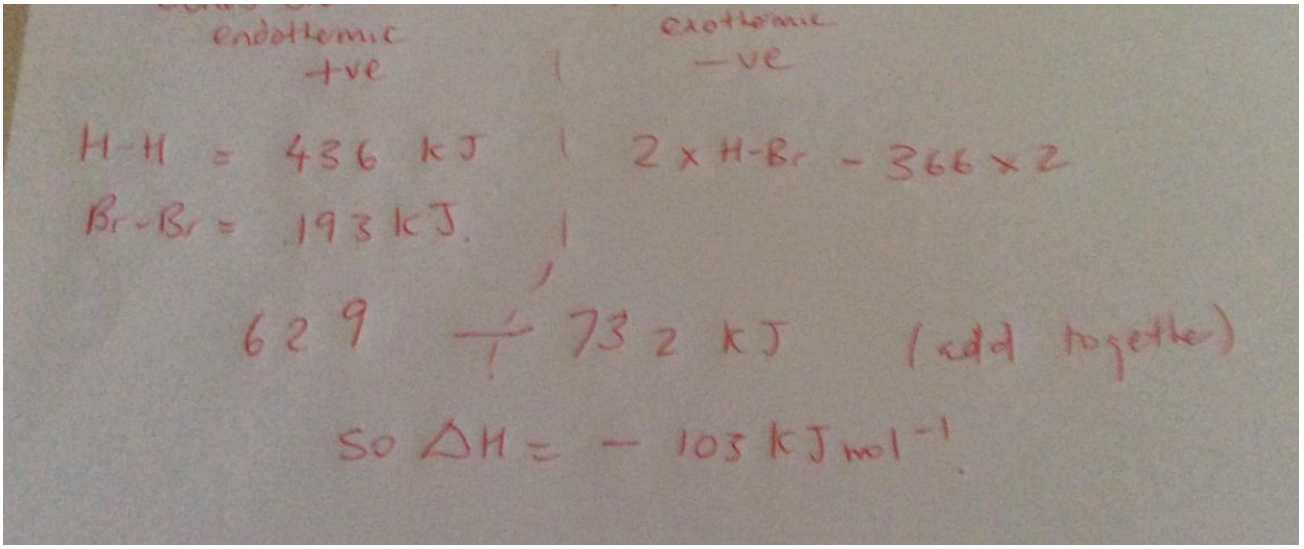
An allotrope is an element that can exist in two forms. It has different forms because the atoms are arranged in space differently. Diamond has carbon atoms each covalently bonded to four other carbon atoms in a 3D network structure. Graphite consists of carbon atoms bonded to 3 other atoms in a sheet. The sheets are layered and between the sheets are delocalized electrons enabling graphite to carry a current. Allotropes have different physical properties. Isotopes are atoms of an element with the same atomic number (number of protons) but different mass number due to a different number of neutrons in the nucleus of the atom. Carbon -14 has 6 protons and 8 neutrons while carbon – 12 has 6 protons and 6 neutrons.

Markers Feedback: A few students confused the terms compounds and elements. Note that there was no mark for just graphite or just diamond you had to have both, also no mark for just carbon -12.

Question 31

Criteria	**Mark**
• Correctly calculates the enthalpy change showing correct working	2
• Correctly calculates the enthalpy change showing incorrect working OR has incorrect sign or shows some correct working	1

Model Response:

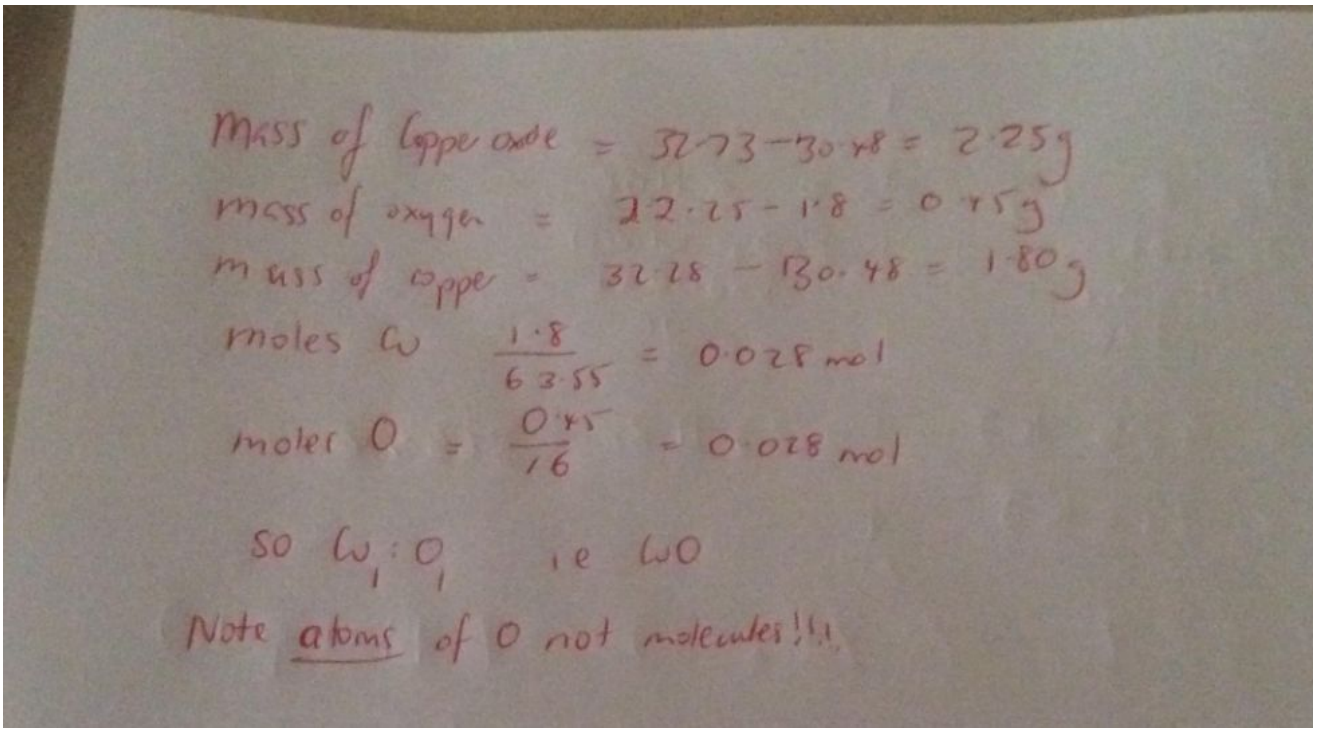


Marker's Feedback: Some students had the correct answer but used an incorrect formula or made an incorrect statement, they could only score one mark. In general this was poorly done and needs work.

Question 32(a)

Criteria	Mark
• Correct answer with correct working	3
• Some correct working	**2**
• Shows some understanding of the calculations required	**1**

Model Response:



Marker's Feedback: Some students made careless errors, some had correct answer by guessing the working had to be shown and be clear. You cannot start with an equation as you do not know the formula is it Copper I oxide or copper II oxide? That is what you are finding out.

Question 32 (b) The test tube and residue was measured every minute to determine when the reaction was complete. The residue had to be weighed to constant mass indicating that the copper oxide had completely decomposed.
1 mark correct answer… Note you had to link constant mass to the reaction being complete to get the whole mark.