Physical Science 436
Name: Answer Key
Date: _____

Part 1: Multiple Choice (4 marks each)

1 Louis found five unmarked bottles in a workroom. Each of the bottles contained a pure substance. He noted the following properties for each of these colourless liquids:

1) boiling point characteristic
2) mass
3) volume
4) density

Which properties does Louis need to know to identify these liquids?

A) 1 and 2

B) 1 and 3

C) 2 and 4

D) 1 and 4

2 Which of the following are physical changes?

I The burning of gasoline in a lawnmower motor
II The dissolving of sugar in hot coffee
III The shattering of a glass
IV The rusting of a piece of iron
V The evaporation of water by the sun's heat

A) I and II

B) I, IV and V

C) II and III

D) II, III and V

3 Three well-known gases have been identified during laboratory experiments :

a) oxygen (O_2) 3
b) carbon dioxide (CO_2) 1
c) hydrogen (H_2) 2

The following are three characteristic properties.

1) The gas turns limewater cloudy. CO_2
2) The gas explodes when exposed to an open flame. H_2
3) The gas rekindles a glowing splint. O_2

Match each gas with the characteristic property that identifies it.

A) a and 1 X
b and 2
c and 3

B) a and 2
b and 1
c and 3

C) a and 3 ✓
b and 1 ✓
c and 2

D) a and 3 ✓
b and 2 X
c and 1

4 For breakfast, Robert takes a loaf of bread out of the freezer.

1. He lets the loaf defrost on the counter.
2. He cuts several slices of bread.
3. He toasts the slices in the toaster.
4. He spreads them with butter, which quickly melts on the hot toast.

In which step did a chemical change occur?

A) 1

B) 2

C) 3

D) 4

toast ≠ bread

In the laboratory, Christian performs experiments on two pure substances that he has been given. He records the following observations:

Substance 1

Characteristic	Before Heating	After Heating to 400°C
Conductivity	none	none
Colour	white	white
Form	powder	granular
Magnetism	none	none
Mass	15.25 g	13.50 g
Solubility in water	yes	no
	Note. A gas is released upon heating; this gas has a characteristic odour and is brownish in colour.	

Substance 2

Characteristic	Before Heating	After Heating to 400°C
Conductivity	good	good
Colour	gray	gray
Form	rectangular	round
Magnetism	none	none
Mass	22.60 g	22.60 g
Density	11.40 g/cm^3	11.40 g/cm^3
Solubility in water	none	none

With the help of these notes, Christian has to describe each of these two substances in terms of an element or a compound.

Which statement best corresponds to the descriptions that Christian should give?

A) Substance 1 is a compound; substance 2 could be a compound or an element.

B) Substance 1 is an element; substance 2 is a compound.

C) Substance 1 could be a compound or an element; substance 2 could be a compound or an element.

D) Substance 1 could be a compound or an element; substance 2 is an element.

6 While identifying an unknown substance in the laboratory, you note that it has the following properties:

1. Its melting point is 0°C; water
2. It is colourless; anything almost
3. It does not change the colour of neutral litmus paper; d H_2O or other
4. It does not conduct electricity.

↳ not ABS

Which of these properties most clearly indicates that the unknown substance is pure water?

A) 1

B) 2

C) 3

D) 4

7 The equation below represents a neutralization reaction:

$$Ca(OH)_2 + 2\,HCl \rightarrow CaCl_2 + 2\,H_2O$$

R | P

Identify the products in this reaction.

A) $Ca(OH)_2$ and HCl

B) HCl and $CaCl_2$

C) $CaCl_2$ and H_2O

D) H_2O and $Ca(OH)_2$

8 Most electrical wiring used in houses is made of copper.

Which of the following properties of copper account for its use in electrical wiring?

A) Its electrical conductivity and its ductility best answer !

B) It electrical conductivity and its mass

C) Its ductility and its melting point

D) Its mass and its melting point

9 Which of the following chemical equations **IS NOT** properly balanced?

A) $N_2 + 3\ Cl_2 \rightarrow 2\ NCl_3$

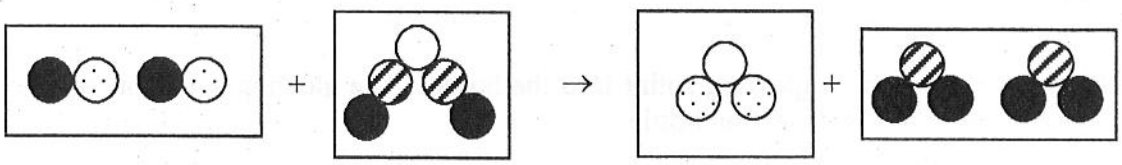
B) $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$

C) $2\ HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$

D) $H_2SO_4 + 2\ NaOH \rightarrow Na_2SO_4 + H_2O$

10 The following model represents a balanced neutralization reaction involving an acid and a base.

O = ⊘ H = ● Cl = ⊙ Ca = ○



Which of the following correctly represents this neutralization reaction?

A) $2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$

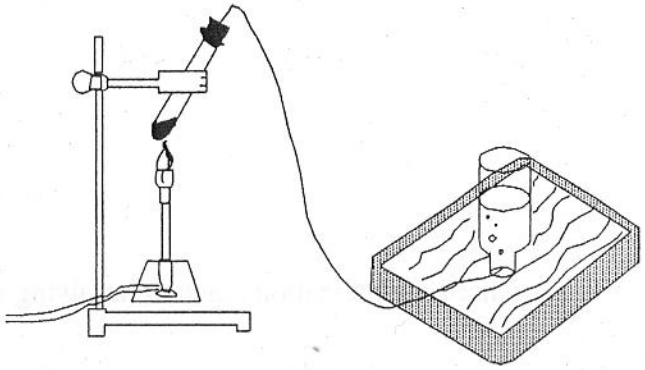
B) $H_2Cl_2 + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$

C) $H_2Cl_2 + CaO_2H_2 \rightarrow CaCl_2 + H_4O_2$

D) $2HCl + CaO_2H_2 \rightarrow CaCl_2 + H_4O_2$

Part 2: Show your work. Explain using point form. (4 marks each)

1 A student heats 2.0 g of an orange powder in a test tube placed as shown in the diagram below.



Droplets of a silver liquid form on the sides of the test tube and a gas is collected by the displacement of water in a bottle set up for this.

The gas is tested by inserting a glowing splint into the bottle. The glowing splint bursts into flames when it is inserted into the gas collecting bottle.

The mass of the orange powder after heating is 1.6 g.

Which of the following three substances is a compound: the orange powder, the silver droplets or the gas?

Justify your answer. orange powder = cpd

- cc
- mass ↓
- cpd before

To find the density of a solid, a student measured its mass and then determined its volume by the displacement of water.

The measurement results are given in the table below.

Mass	Volume	
	Water	Water + Solid
12.32 g	15.0 mL	19.4 mL

What is the density of this solid?

19.4mL
−15.0 mL
4.4mL = vol

$D = \frac{m}{V} = \frac{12.32\,g}{4.4\,mL} = \frac{2.8\,g}{mL} = D$

Balance the following equation:

$Mg_3(PO_4)_2 + 6LiCl \rightarrow 3MgCl_2 + 2Li_3PO_4$

3Mg	6 X Li	3 X Mg	6 X Li
2P	6 X Cl	6 X Cl	2 X P
8O			8 O

4 The balanced equation for a particular chemical reaction is

$$NaNO_3 + H_2SO_4 \rightarrow NaHSO_4 + HNO_3$$

8.5g 9.8g 12.0g

In the laboratory, you react 8.5 g of $NaNo_3$ with 9.8 g of H_2SO_4 and obtain 12.0 g of $NaHSO_4$ and a certain quantity of HNO_3.

What is this quantity of HNO_3? **Explain using math.**

mass R = mass P

8.5g + 9.8g = 12.0g + X

18.3g

− 12.0g

18.3g − 12.0g = 6.3g

5 Indicate the **type** of chemical reaction:

A) $NaOH + HCl \rightarrow NaCl + H_2O$ acid/base OR DD

B) $2\ Mg + O_2 \rightarrow 2\ MgO$ synthesis/combination

C) $2\ Mg + 2\ HNO_3 \rightarrow Mg(NO_3)_2 + H_2$ SD

D) $KClO_4 \rightarrow KCl + 2\ O_2$ Decomp

6 Give the names of the following elements:

A) K potassium

B) Ca calcium

C) P phosphorus

D) Na sodium

Physical Science 436 IMM
October 13, 2005

Name : _____

Test: Changes

Each Question is worth 4 marks

Multiple Guesses

1. Which of the following phenomena is associated with a chemical change?

   A) The water in a lake freezes.
   B) An iron fence rusts.
   C) A heavy rain causes flooding.
   D) Dew forms.

2. After observing certain events, a student tried to classify each as a physical change or a chemical change, as shown in the following table.

EVENT	TYPE OF CHANGE
1. The water in a stream freezes.	Chemical
2. Salt dissolves in water.	Physical
3. Wood catches fire.	Chemical
4. An iron rod rusts.	Physical

   Which events are classified correctly?

   A) 1 and 2
   B) 1 and 4
   C) 2 and 3
   D) 3 and 4

3. In the laboratory, you are given a pink powder in a test tube. Your teacher tells you that it is a **pure substance**. = ele or cpd ppd of gas colour change ∴ CC

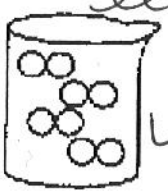
   When you heat the test tube, you observe that a gas is given off and a black residue forms.

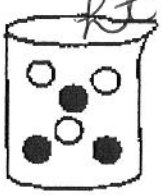
   What can you conclude about the original substance? (2) loss of mass (1)

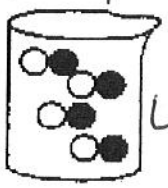
   A) It is an element.
   B) It is a compound.
   C) It is a solution.
   D) It is a mixture.

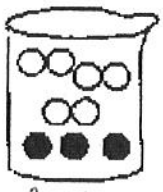
   (3) ∴ cpd before

4. The four models below represent matter.

1) 

2) 

3) 

4) 

Which of these models represent(s) a pure substance?

A) Model 1 only
B) Models 1 and 3
C) Models 2 and 4
D) Models 2, 3 and 4

5. Which of the following chemical equations IS NOT properly balanced?

A) $N_2 + 3\ Cl_2 \rightarrow 2\ NCl_3$

B) $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$

C) $2\ HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$

D) $H_2SO_4 + 2\ NaOH \rightarrow Na_2SO_4 + H_2O$

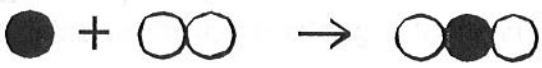
6. The incomplete combustion of carbon, C, in an environment containing little oxygen gas, O_2, produces a toxic gas called carbon monoxide, CO.

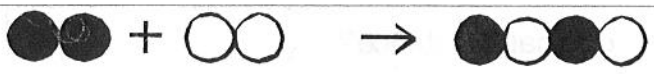
This reaction is represented by the following equation :

$$2\ C + O_2 \rightarrow 2\ CO$$

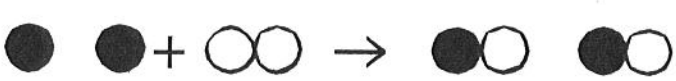
Which of the following models correctly represents this reaction?

[● : carbon ○ : oxygen]

A) 

B) 

C) 

D) 

7. Three different substances were heated separately in crucibles.

The table below presents the observations noted during the experiments.

Experiment	Characteristics of the substance before heating	Characteristics of the substance after heating
1	The substance is a yellow solid with a mass of 100 g.	The substance is a yellow liquid with a mass of 100 g.
2	The substance is a silvery solid with a mass of 150 g.	The substance is a silvery liquid with a mass of 150 g.
3	The substance is a silvery solid with a mass of 50 g.	The substance is a white solid with a mass of 83.3 g. CC & ↑ mass

For which experiment can one conclude positively that the substance was a compound after being heated?

Justify your answer by giving two reasons.

Experiment n° 3 because:

1st reason: 1 CC bec of colour change

2 mass ↑

2nd reason: ∴ cpd after

8. You are given a red powder and asked to determine its composition.

After heating the red powder at high temperature, you obtain a liquid and a gas. loss of mass

From these results state whether the substance was an element or a compound. Justify your answer.

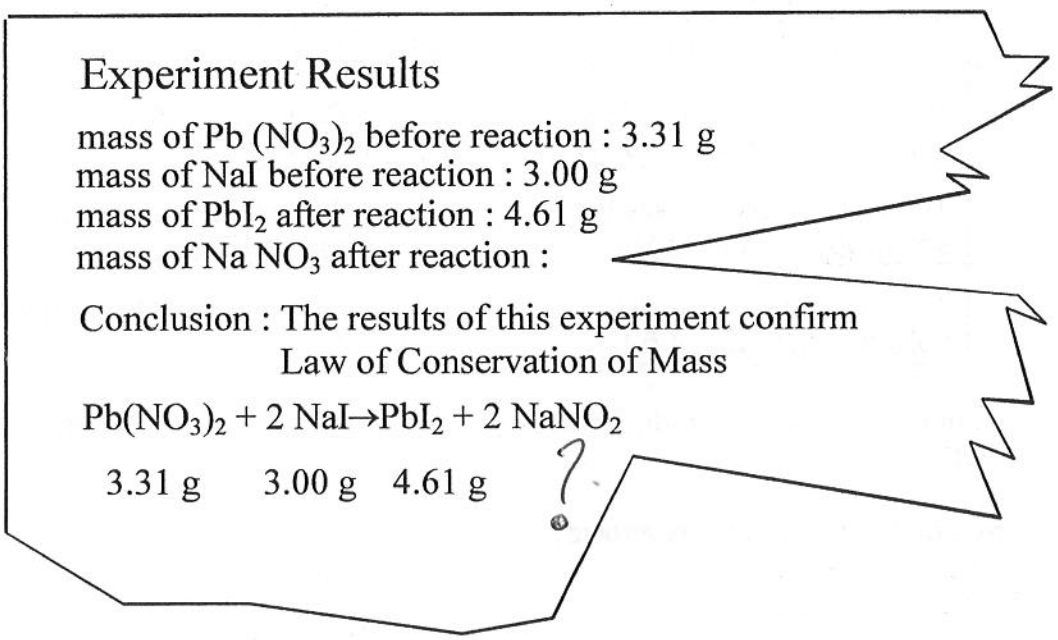
(1) CC gas produced

(2) mass will ↓ as gas given off

(3) cpd before (red powder)

9. While consulting some old documents, you find a lab report written in 1968.

Here is part of the document.



Experiment Results

mass of $Pb(NO_3)_2$ before reaction : 3.31 g
mass of NaI before reaction : 3.00 g
mass of PbI_2 after reaction : 4.61 g
mass of $Na\ NO_3$ after reaction :

Conclusion : The results of this experiment confirm Law of Conservation of Mass

$Pb(NO_3)_2 + 2\ NaI \rightarrow PbI_2 + 2\ NaNO_2$

3.31 g 3.00 g 4.61 g ?

You notice that the mass of one of the products, $NaNO_3$ is missing. If all of the reactants were used up, what must be the missing mass of $NaNO_3$?

Show all your work. $(3.31g + 3.00g) - 4.61g = ?$

$= 2.00g$

10. Balance the following chemical equation.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

11. Balance the following chemical equation.

$$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$$

12. Given the following chemical reaction:

$$MnO_2 + 4\,HCl \rightarrow Cl_2 + MnCl_2 + 2\,H_2O$$

What are the reactants? MnO_2 & HCl

What are the products? Cl_2 & $MnCl_2$ & H_2O

13. Using nitrogen (N_2), hydrogen (H_2) and nitrogen oxide (NH_3), write a balanced chemical equation to represent a synthesis reaction.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

14. Using oxygen (O_2), chlorine (Cl_2), hydrochloric acid (HCl) and water (H_2O), write a balanced chemical equation to represent a single displacement reaction.

$$2HCl + \frac{1}{2}O_2 \rightarrow H_2O + Cl_2$$

15. In your own words, describe how you synthesized a compound in the lab.
*Hint: State what substances were used and obtained, and **briefly** describe what you did.*

$$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$$

LST $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$