

Some of the formatting is  
Messed up. Apologies.

PLEASE DO NOT WRITE ON THIS TEST PAPER

Part A - Multiple Choice. ( 75 MARKS)

1. Your lab partner is adding acid to a series of test tubes when one suddenly erupts in her face.  
a) first aid kit.  
b) eyewash station.  
 c) teacher.  
d) medical room.
2. Five kilometers are equal to how many centimeters?  
a)  $5.0 \times 10^5$  cm.  
b)  $5.0 \times 10^3$  cm  
c)  $5.0 \times 10^9$  cm.  
 d)  $5.0 \times 10^5$  cm.  
*5000m x 100cm / 1m*
3. Which one of the following measurements is expressed with three significant figures?  
 a)  $7.30 \times 10^{-7}$  km.  
b) 0.007 m.  
c) 0.070 mm.  
d) 7077 mg.
4. Suppose that the most accurate atomic weights available for silver, boron, and fluorine are:  
Ag: 107.868; B: 10.81; F: 18.998403  
The number of significant figures that should be reported in the calculated molar mass of  $\text{AgBF}_4$  is:  
 a) five b) six c) seven d) eight  
*adding ... so*  
 $194.671612 \Rightarrow 194.\underline{6}\underline{7}$
5. The sum of the experimentally measured quantities  $15.0 + 0.379 + 5.12$  is best expressed as ...  
 a) 20.5  
b) 20.50  
c) 21  
d) 20.499  
*20.499*  
*20.5*
6. Which of the following statements provides the best evidence for the existence of ions?  
a) non-metals form covalent bonds.  
b) metals are good electrical conductors.  
c) salts are composed of metals and non-metals.  
 d) salt solutions are good electrical conductors.

7. Which one of the following is NOT a physical property of water? a) boiling point is 100 degrees Celcius. b) colourless liquid. c) composed of hydrogen and oxygen. d) sugar dissolves in it. *not a good Q.*
8. Metallic gold (1) conducts electricity, (2) is yellow, (3) does not corrode, (4) has a density of 19.3 g/cm<sup>3</sup>, (5) melts at 1063 oC. Which of these are physical properties?  
a) 1,2,4,5 b) 1,2,5  
c) 3,4,5  
d) none of them
9. When substance V is heated a net gain in mass is recorded. This is best described as....  
a) a physical change.  
b) melting.  
c) a chemical change.  
d) a decomposition.
10. The correct name for (NH<sub>4</sub>)<sub>2</sub>CrO<sub>4</sub> is:  
A. ammonia dichromate  
B. ammonia chromate  
C. ammonium dichromate  
D. ammonium chromate

Refer to the following information when answering questions 11, 12, 13, 14, and 15.

A scientist had the opportunity to collect samples of matter from two previously unexplored planets. Upon returning to his spacecraft, he recorded the following information in his notebook.

- Sample 1      green powder, uniform appearance; dissolves readily in ethanol.
- Sample 2      purple crystals and orange particles; purple crystals dissolve in water.
- Sample 3      yellow pebbles, uniform appearance; releases a gas upon heating.
- Sample 4      blue liquid which evaporates readily and leaves behind a white residue

11. The data for sample 3 indicates that upon heating the yellow pebbles probably... a) decompose.  
b) disintegrate.  
c) matt.?  
d) vaporise.

12. If the scientist stated in his report that Sample 1 was most likely an element, he would be making .....

- a) an observation.
- b) an interpretation.
- c) a conclusion.
- d) a hypothesis.

*inference would also work*

13. The purple and orange particles in sample 2 could best be separated by...

- a) distillation.
- b) adding water and then filtering.
- c) evaporation and distillation.
- d) heating.

14. The sample which is most likely a mixture would be....

- a) Sample 1
- b) Sample 2
- c) Sample 3
- d) Sample 4

15. Which of the scientist's samples is most likely heterogeneous?

- a) Sample 1
- b) Sample 2
- c) Sample 3
- d) Sample 4

16. When a substance is heated, the energy that is absorbed results in the particles being...

- a) arranged more randomly and moving more slowly.
- b) arranged less randomly and moving more quickly.
- c) arranged more randomly and moving more quickly.
- d) arranged less randomly and moving more slowly.

17. A substance which releases  $H^+$  ions when mixed in water is best described as.... a)

- a) a base.
- b) a salt.
- c) a hydride.
- d) an acid.

18. Which of the following is the most likely formula for the combination of nitrogen and chlorine?

- a)  $NC_3$
- b)  $NCI$
- c)  $N_2Cl_3$
- d)  $N_5Cl_3$

19. The correct name for  $K_2Cr_2O_7$  is most likely...

- a) Potassium chromium oxide.
- b) potassium dichromate.
- c) potassium chromoxide.
- d) potassium heptaoxide.

20. Which one of the following formulas most likely represents a compound formed from strontium and bromine?

- a) Sr2Br
- b) SrBr
- c) SrBr2
- d) Sr2Br2

21. Which one of the following is the most likely mass for 11.2 L of chlorine gas at STP?

- a) 8.9 g
- b) 17.8 g
- c) 35.5 g
- d) 70.0 g

$$11.2 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} \times \frac{71.0 \text{ g}}{\text{mol}} =$$

22. Isotopes of an element vary in the number of ... a) protons.

- b) electrons.
- c) neutrons.
- d) nucleons.

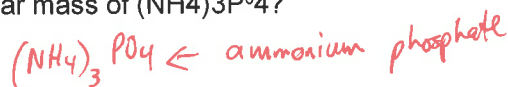
23. If the atomic mass of carbon-12 had been assigned exactly 100 amu, instead of 12 amu, the atomic mass of oxygen would have been:

- a) 16
- b) 104
- c) 133
- d) 128

$$\frac{16}{12} \times 100 =$$

24. Which one of the following best describes the molar mass of (NH4)3PO4?

- a) 113 g/mol
- b) 121 g/mol
- c) 149 g/mol
- d) 239 g/mol



25. Which of the following units is best suited to describing a large number of things? a) a dozen.

- b) a mole.
- c) a gross.
- d) a metric tonne.

26. How many molecules would be inside a balloon containing 0.40 moles of H2 gas?

- a)  $2.4 \times 10^{23}$
- b)  $4.8 \times 10^{23}$
- c)  $6.02 \times 10^{23}$
- d)  $2.4 \times 10^{24}$

$$0.40 \text{ moles} \times \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} =$$

27. Which of the following is the most likely mass for 0.850 moles of AuCl2?

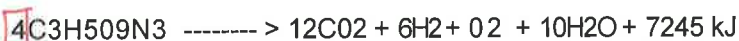
- a) 228 g
- b) 267 g
- c) 268 g
- d) 314 g

$$0.850 \times 268 \text{ g/mol} =$$

28. "Equal volumes of gases under the same conditions of temperature and pressure contain equal numbers of particles." This statement is best described as... a) Boyle's law.  
 b) Guy-Lussac's Gas law.  
 c) Molar law.  
 d) Avogadro's hypothesis.

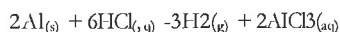
29. In a chemical reaction the mass of the products...  
 a) is less than the mass of the reactants.  
 b) is greater than the mass of the reactants.  
 c) is equal to the mass of the reactants.  
 d) has no relationship to the mass of the reactants.

Use the following equation for the explosion of nitroglycerine to answer questions 30, 31,



30. This reaction is best described as: a) a synthesis reaction. b) a combustion reaction. c) an endothermic reaction. d) an exothermic reaction.
31. if only one mole of nitroglycerine was used, the amount of heat energy released would most likely be...  
 a) 906 kJ  
 b) 1811 kJ  
 c) 3622 kJ  
 d) 14,490 kJ

32. When 10.0 g of aluminum react according to the equation



What volume of hydrogen gas at STP is produced?

A. 5.53L

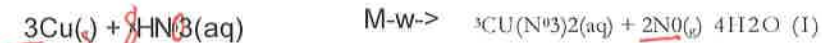
B. 12.4L

C. 90.7L

D. 336L

$$10g \times \frac{1 \text{ mol Al}}{27g} \times \frac{3 \text{ H}_2}{2 \text{ Al}} \times \frac{22.4 \text{ L}}{1 \text{ mol H}_2}$$

Refer to the following equation when answering questions 33, 34, and 35.



33. If you could drop 12 atoms of copper into a beaker containing the nitric acid, how many molecules of NO would be produced?  
 a) 2  
 b) 8  
 c) 12  
 d) 18

34. Calculate the moles of water produced when 6.6 moles of  $\text{Cu}(\text{NO}_3)_2$  are formed in the reaction.

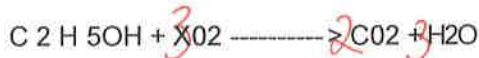
- a) 4 moles. b) 4.9 moles. c) 6.6 moles. d) 8.8 moles.

35. How many grams of Copper would be needed to react with 4.0 moles of  $\text{HNO}_3$ ?

- a) 1.50 grams. b) 63.5 grams. c) 95.3 grams. d) 191 grams.

$$1.5 \text{ moles} \times 63.5 =$$

36. Determine the coefficient X when one mole of  $\text{C}_2\text{H}_5\text{OH}$  is used in the following equation.



- a) 2 b) 5 c) 7 d) 3

37. In which of the following reactions do the reactants change partners? a)

- double displacement.  
b) synthesis.  
c) decomposition.  
d) single displacement.

Refer to the following equation when answering question 38.



38. If 15 L each of  $\text{H}_2$  and  $\text{N}_2$  is allowed to react, how many liters of  $\text{NH}_3$  will be produced?

- a) 10 L b) 15 L c) 20 L d) 30 L

$\text{H}_2$  requires 3x as much as  $\text{N}_2$   
so only 5L of  $\text{N}_2$  reacts.  
all 15L of  $\text{H}_2$  used.

Refer to the following equation when answering question 39. Mg



39. If 2.43 g of magnesium is allowed to react with an excess amount of  $\text{HCl}$ , how many grams of  $\text{MgCl}_2$  will be produced?

- a) 4.76 g b) 9.53 g c) 9.73 g d) 95.3 g

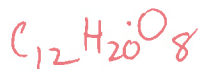
$$1:1 \text{ so } 2.43\text{g} \times \frac{1}{24.3} = 0.1 \text{ mol Mg} \\ = 0.1 \text{ mol MgCl}_2$$

40. A compound has an empirical formula  $C_3H_5O_2$  and a molecular weight of 292.  $\frac{292}{73} = 4$

The molecular formula is...

- a)  $C_{15}H_{25}O_{10}$
- b)  $C_{13}H_{24}O_7$
- c)  $C_{12}H_{20}O_8$
- d)  $C_9H_{15}O_6$

↑  
73

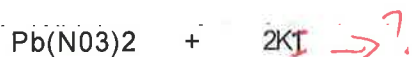


Refer to the following equation when answering question 41.

sodium carbonate plus tin(II) nitrate forms .....

41. Which one of the following is most likely a product of the above reaction? a) tin II nitrate  
b) sodium carbonate  
c) sodium carbonate and tin II carbonate  
d) sodium nitrate

none: should be tin(II) carbonate



- A)  $PbN + 2KIO_3$
- b)  $PbI_2 + 2KNO_3$
- c)  $PbK + INO_3$
- d)  $PbKI + 2NO_3$

43. In which of the following pairs does each ion have a stable octet configuration?

- a)  $Br^-$ ,  $Ge^{3-}$
- b)  $Se^{2+}$ ,  $O^{2-}$
- c)  $Be^{2+}$ ,  $As^{3-}$
- d)  $Tel^-$ ,  $O^-$

44. Element # 112 was recently discovered by some German scientists. What does electron configuration end in? its

a)  $5f^{15}$  b)

c)  $5f^{14}d^{10}$

c)  $7s^2sd^6$

a)  $7s^26d^{10}?$  ...

45. Which one of the following conditions best describes covalent bonding? a)

shared electrons.

- b) Noble gas configuration.
- c) metal plus non-metal.
- d) electron transfer.

46. In which of the following molecules does the central atom violate the "octet rule"? a)

- OF<sub>2</sub>
- b) SF<sub>4</sub>
- c) PF<sub>3</sub>
- d) ClF

47. Which one of the following compounds possesses an ionic bond?

- a) Rb<sub>2</sub>O
- b) CO
- c) SiCl<sub>4</sub>
- d) NH<sub>3</sub>

48. Given the following electron configurations, representing neutral atoms, answer the following.

Which electron configuration above, represents the atom having the lowest second ionization energy?

- a) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup> •
- b) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>1</sup> c) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup>
- d) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>5</sup>
- e) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>3</sup>

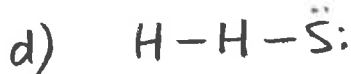
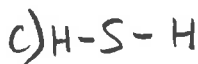
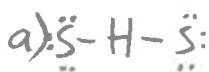
49. The Bohr model of the atom is characterized by...

- a) electrons and protons mixed equally.
- b) electrons orbiting the nucleus in circular orbits.
- c) electrons occupying set energy levels about the nucleus.
- d) electrons occupying the nucleus along with the protons.

50. The complete electron configuration of Ge is...

- a) 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>3d<sup>4</sup> •
- b) 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>3d<sup>10</sup>4s<sup>2</sup>4p<sup>2</sup>
- c) 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>4s<sup>2</sup>4p<sup>2</sup>4d<sup>10</sup>
- d) 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>2d<sup>10</sup>3s<sup>2</sup>3p<sup>6</sup>4s<sup>2</sup>4p<sup>2</sup>

51. Which of the following represents the Lewis structure for Hydrogen sulphide?



52. Which one of the following best describes the halogens?

- a) all are metals which are good conductors.
- b) have low reactivity and a high melting point.
- c) are highly reactive non-metals.
- d) as the molar mass increases, the melting point decreases.



5 3 . Elements are organized in the present periodic table according to...

- a) alphabetical sequence.
- b) their increasing activity.
- c) increasing atomic mass.
- d) increasing atomic number.

5 4 . Elements in the same chemical family tend to have similar... a)

- a) electron configurations.
- b) atomic numbers.
- c) atomic masses.
- d) numbers of electrons. ← valence ... sure.

5 5 . Which of the following elements has the highest electronegativity?

- a) Te
- b) S
- c) O
- d) B

5 6 . Which of the following descriptions does not, fit the element? a)

- Ge, a metalloid
- b) Ca, an alkali metal
- c) Br, a halogen
- d) Au, a transition metal

5 7 . The general reaction of any alkali metal. "M" with O<sub>2</sub> is...

- a)  $2M + O_2 \rightarrow 2MO$
- b)  $4M + O_2 \rightarrow 2M_2O$
- c)  $M + O_2 \rightarrow M^{+}O_2^{-}$
- d)  $4M + O_2 \rightarrow 2M_2O_2$

5 8 . An unlikely chemical combination is.... a)

- a)  $ArCl_2$
- b)  $5114$  ?
- c)  $Al_2S_3$
- d)  $CuSO_4 \cdot 5H_2O$

5 9 . The number of protons, neutrons , and electrons represented by the symbol



- a) 8 protons, 18 neutrons, 8 electrons
- b) 8 protons, 10 neutrons, 10 electrons
- c) 10 protons, 10 neutrons, 8 electrons
- d) 18 protons, 10 neutrons, 8 electrons

- INSTRUCTIONS:
- \*Show all work in the space provided.
  - \*Include units throughout your calculations and in your final answer.
  - \*Use significant figures in calculating numerical values.

1. Calculate the number of grams of CH<sub>4</sub> represented by 1.25 X 10<sup>24</sup> molecules. (2mk)

$$1.25 \times 10^{24} \text{ molec} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molec}} \times \frac{16.0 \text{ g}}{1 \text{ mol}} = \underline{33.2 \text{ g}}$$

2. How many hydrogen atoms are present in 62.5 L of CH<sub>4</sub> at S.T.P.? (3mk)

$$62.5 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} \times \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \times \frac{4 \text{ H's}}{\text{molec.}} = \underline{6.72 \times 10^{24} \text{ H's}}$$

3. Determine the % (by mass) of Cr in the compound (NH<sub>4</sub>)<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. (2mk)

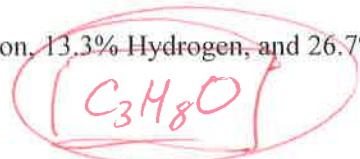
$$\begin{aligned} 2 \times \text{Cr} &= 104 \text{ g} \\ (\text{NH}_4)_2 \text{Cr}_2 \text{O}_7 &= 252 \text{ g} \end{aligned} \quad \% = \frac{104 \text{ g}}{252 \text{ g}} \times 100\% = \underline{41.3 \%}$$

4. How many grams of sugar (C<sub>12</sub>H<sub>22</sub>O<sub>11</sub> = 342 g/mol) are needed to make 4.00 L of a 0.250 molar (M) sugar solution? (2mk)

$$4 \text{ L} \times 0.250 \frac{\text{mol}}{\text{L}} = 1 \text{ mol sugar} \times \frac{342 \text{ g}}{\text{mol}} = \underline{342 \text{ g Sugar.}}$$

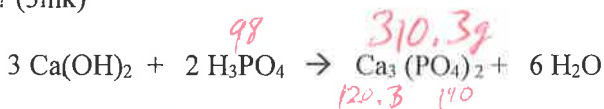
5. Determine the empirical formula of a compound that is 60.0% carbon, 13.3% Hydrogen, and 26.7% Oxygen. (3mk)

☆ assume 100g.



$$\begin{aligned} 60 \text{ g} \times \frac{1 \text{ mol}}{12 \text{ g}} &= 5 \\ \frac{5}{1.67} &= \underline{3} \\ 13.3 \text{ g} \times \frac{1 \text{ mol}}{1 \text{ g}} &= 13.3 \\ \frac{13.3}{1.67} &= \underline{7.96} \\ 26.7 \text{ g} \times \frac{1 \text{ mol}}{16 \text{ g}} &= 1.67 \\ \frac{1.67}{1.67} &= \underline{1} \end{aligned}$$

6. If we want to produce 300. g of Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> by the reaction given below, how many grams of H<sub>3</sub>PO<sub>4</sub> will be needed? (3mk)



$$300 \text{ g} \times \frac{1 \text{ mol}}{310.3 \text{ g}} = 0.967 \text{ mol} \times \frac{2 \text{ H}_3\text{PO}_4}{1 \text{ Ca}_3(\text{PO}_4)_2} = 1.934 \text{ mol H}_3\text{PO}_4 \times \frac{98 \text{ g}}{\text{mol}}$$

= 189 g

7. Using 85.0 mL of 4.00 M HCl<sub>(aq)</sub> with 30.5 g of Zn<sub>(s)</sub> in the reaction below, (5mk)



- a) What kind of reaction is this? Single replacement.
- b) Which is the limiting reactant? HCl
- c) What is the maximum litres of H<sub>2</sub> gas that can be produced?

$$0.34 \text{ mol HCl} \times \frac{1 \text{ H}_2}{2 \text{ HCl}} \times \frac{22.4 \text{ L}}{\text{mol}} = \frac{3.81 \text{ L}}{\underline{\underline{7.62 \text{ L}}}}$$

8. You mix Ca(NO<sub>3</sub>)<sub>2(aq)</sub> with K<sub>2</sub>SO<sub>3(aq)</sub>. Predict and write the balanced : (3mk)

FORMULA EQUATION



COMPLETE IONIC EQUATION



NET IONIC EQUATION



9. For each of the following, list (6mk)

- a) an element that is both in the second family and the fifth period
- b) an element that will have similar properties to nitrogen
- c) an element that is in the same family as potassium but with a larger radius
- d) the most reactive element of the halogen family
- d) an example of an element with a oxidation state of +3
- e) an element in the fourth period with the greatest ionization energy

Sr

P, As

Rb, Cs, Fr

F

Al<sup>3+</sup>, B<sup>3+</sup>, Ga<sup>3+</sup>

10. Draw Lewis dot structures for: (4mk)

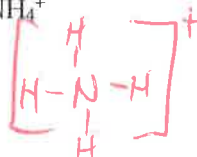
a) NH<sub>3</sub>



b) H<sub>2</sub>O<sub>2</sub>



c) NH<sub>4</sub><sup>+</sup>



d) N<sub>2</sub>

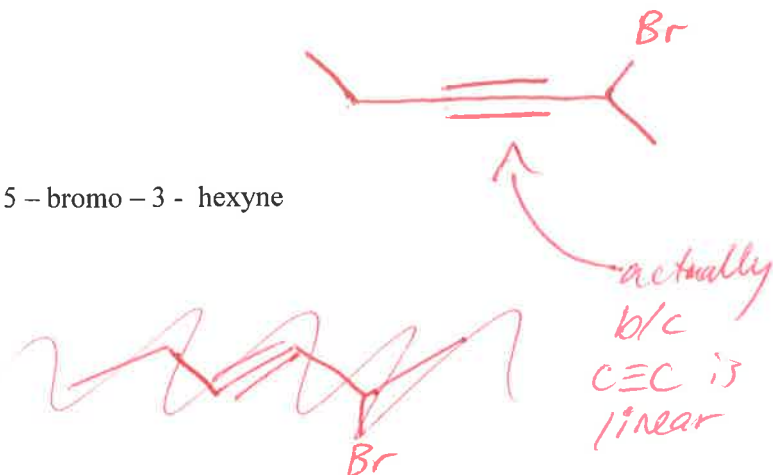


11. Draw the structural formula of: (2mk)

a) 2,3 - dimethylbutane



b) 5 - bromo - 3 - hexyne



12. The following data was obtained during the titration of 25.0 mL of HNO<sub>3</sub> with 0.150 M Ca(OH)<sub>2</sub>.

	<u>Titration 1</u>	<u>Titration 2</u>	<u>Titration 3</u>
Volume of <del>NaOH</del> <sup>Ca(OH)<sub>2</sub></sup>	19.6 mL <i>under shot</i>	22.5 mL <i>good</i>	22.4 mL

a) Write the balanced neutralization reaction. (1mk)



b) What is the concentration of the acid? (3mk)

$$\frac{22.5 + 22.4}{2} = 22.45 \text{ mL} \times 0.150 \frac{\text{mol}}{\text{L}} \times \frac{2 \text{ HNO}_3}{1 \text{ Ca(OH)}_2} = 6.735 \text{ mmol HNO}_3$$

$$\frac{6.735 \text{ mmol}}{25.0 \text{ mL}} = \underline{0.269 \text{ M}}$$

13. Use the lab data below, along with the balanced chemical equation to answer the following:



Mass of crucible and Al <sub>2</sub> (CO <sub>3</sub> ) <sub>3</sub>	27.85 g
Mass of crucible only	25.81 g
Mass of crucible and Al I <sub>3</sub>	34.95 g

a) What mass of Al<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub> was used? 2.04 g

b) What mass of Al I<sub>3</sub> was produced? 9.14 g

c) Theoretically, what should have been the mass of Al I<sub>3</sub> produced? (3mk)

$$2.04 \text{ g Al}_2(\text{CO}_3)_3 \times \frac{1 \text{ mol}}{234 \text{ g}} = 0.0087179 \text{ mol} \times \frac{2 \text{ AlI}_3}{1 \text{ Al}_2(\text{CO}_3)_3} \times \frac{407.7 \text{ g}}{1 \text{ mol}} = 7.1086 \text{ g}$$

d) Using the theoretical and actual values of Al I<sub>3</sub>, calculate the % yield. (2mk)

$$\frac{9.14 \text{ g}}{7.109 \text{ g}} \times 100\% = \underline{129\%} \text{ (probably still damp)}$$