AN EXAMPLE OF HOMEWORK AND EXAM MARKING GUIDE
GENERAL CHEMISTRY
Hanoi University of Science and Technology – TROY Program

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Question 1. A glass vessel calibrated to contain 70 oz of water at 4°C was found to weigh 7.03 lbs when empty and dry. Filled with a sodium chloride solution at the same temperature, it was found to weigh 11.99 lbs. Calculate the solution's density in g/mL.

Criteria	Points
Summary of the given information: Vessel's volume: 70 oz Vessel's weight: 7.03 lbs Vessel and sodium chloride solution's weight: 11.99 lbs	0.25
Restatement of the expected answer: density of sodium chloride in g/mL	0.25
Conversion factors and equation: 1 oz / 29.57 mL 1 lbs / 453.6 g	0.25
Equation: Density = mass/volume	0.25
Weight of solution = 11.99 lbs – 7.03 lbs = 4.96 lbs	0.25
Volume of the solution = Volume of the vessel = 70 oz	0.25
Density of solution = $\frac{4.96\ lbs}{70\ oz} \times \frac{1\ oz}{29.57\ mL} \times \frac{453.6\ g}{1\ lbs} = \boxed{1.08\ g/mL}$ *(3 significant figures, boxed)*	0.5

Question 2. The specific heat of the glass used in thermometermanufacture is 0.84 $Jg^{-1}K^{-1}$. Calculate the heat in calories released to the surrounding when a 10-gram thermometer decreases its temparature from 39 degrees Celsius to 37 degrees Celsius.

Criteria	Points
Summary of the given information: Mass: m = 10 g Specific heat: C = 0.84 $Jg^{-1}K^{-1}$ Initial temperature: t_{intial}= 39 °C Final temperature: t_{final} = 37 °C	0.25
Restatement of the expected answer: released heat in calories	0.25
Conversion factors and equations: 1 cal / 4.184 J K = 273.17 + C	0.25
H = CmΔt	0.25
Temperature change: $\Delta t = t_{final} - t_{initial} = (37 + 273.15) – (39 + 273.15) = - 2$ K	0.5
Released heat = H = $\frac{0.84 J}{gK} \times \frac{1 cal}{4.184 J} \times 10g \times (-2K) = \boxed{\textbf{\textit{- 4.0 cal}}}$ *(negative, 2 significant figures, boxed)*	0.5

Question 3. Analysis of 4.200 g of vitamin C (ascorbic acid) yields 1.720 g of carbon, 0.190 g of hydrogen, and 2.290 g of oxygen. Calculate the mass percentage of each element in the compound. Should there be other elements in ascobic acid?

Criteria	Points
Summary of the given information: Ascobic acid: m = 4.200 g C: m_C = 1.720 g H: m_H = 0.190 g O: m_O = 2.290 g	0.25
Restatement of the expected answer: mass percent of each element, % other elements in ascobic acid	0.25
Equation: Mass percent = 100% *mass of element/total mass	0.25
Mass percent of carbon in ascobic acid = $100\% \times \frac{1.720\ g}{4.200\ g} =$ 40.95 %	0.25
Mass percent of hydrogen in ascobic acid = $100\% \times \frac{0.190\ g}{4.200\ g} =$ 4.52 %	0.25
Mass percent of oxygen in ascobic acid = $100\% \times \frac{2.290\ g}{4.200\ g} =$ 54.52 %	0.25
	0.25
The total mass of C, H and O = $m_C + m_H + m_O$ = 1.720 + 1.090 + 2.290 = 4.200 g = m There is no other elements in ascobic acid	0.5

Question 4: An ion was found to contain 13 protons, 15 neutrons, and 10 electrons.
   (a) Write a symbol that represents the given information.
   (b) What if 2 protons and 5 electrons are added to the ion?

(a) **Summary of the given information:** p = 13, n = 15, e = 10	0.1
Restatement of the expected answer: symbol that represent the ion	0.1
Atomic number = p = 13	0.1
Atomic symbol = Al	0.2
Atomic mass = n + p = 15 + 13 = 28	0.2
Charge = p – e = 13 – 10 = +3	0.1
The symbol that represents the given information is $^{28}_{13}Al^{3+}$	0.2
(b) **Summary of the given information:** 2 protons and 5 protons added	0.1
Restatement of the expected answer: symbol that represent the newly formed species	0.1
Atomic number = p + 2 = 15	0.1
Atomic symbol = P	0.2
Atomic mass = n + p = 15 + 15 = 30	0.2
Charge = p +2 – (e +5) = 13 +2 – (10 + 5) = 0	0.1
The symbol that represents the ion is $^{30}_{15}P$	0.2

Question 5. Predict whether each of the following compounds is ionic or molecular, based on its formula:
a) $BaCl_2$
b) $SeCl_2$

Ba is a metal from group 2A, thus it is ready to donate 2 electrons to fullfil the octet rule Cl is a nonmetal from group 7A, thus it is ready to receive 1 electron or share its electrons with another spcies to fullfil the octet rule The donating – receiving relationship between Ba and Cl forms an ionic compound. Hence, $BaCl_2$ is an ionic compound.	1
Se is a nonmetal from group 6A, thus it is ready to receive 2 electron or share its electrons with another spcies to fullfil the octet rule Cl is a nonmetal from group 7A, thus it is ready to receive 1 electron or share its electrons with another spcies to fullfil the octet rule Electron sharing between Se and Cl forms a molecular compound. Hence, $SeCl_2$ is an ionic compound.	1

Note: No point is given to a short statement as " $BaCl_2$ is an ionic compound"