

**Revised August 2008**

## AP WORKED ANSWERS

**1991, 6**

**Points 2, 3, 1, 2**

### **APPROACH #1, combining parts (a), (b) and (c) altogether.**

(a), (b) and (c)

$$\text{Use } P V = n R T = \frac{\text{mass}}{\text{Molar Mass}} R T$$

- Mass the empty flask
- Add a small amount of liquid to the flask
- Immerse in hot water in order to vaporize the volatile liquid and to fill the flask with vapor
- Remove the flask from the water bath, cool in ice bath and dry
- Mass the flask PLUS the condensed vapor
- Fill the flask completely with water and record its volume using the graduated cylinder
- Record Temperature and Pressure
- Calculate mass of vapor by subtracting the mass of the empty flask from the Mass of the flask PLUS the condensed vapor

$$\text{Apply Use } P V = \frac{\text{mass}}{\text{Molar Mass}} R T$$

(d) If the liquid contains impurities then the mass used in the equation in (c) would be too large. Should be using a smaller number. This makes Molar Mass too large.

### **APPROACH #2, treating parts (a), (b) and (c) separately.**

(a)

Mass of the empty flask  
Mass of condensed gas (liquid) + flask  
Atmospheric Pressure  
Volume of flask  
Temperature

(b)

- Cool the vapor to condense it and then subtract the mass of the empty flask from the mass of the flask PLUS condensed vapor.
- Fill the flask completely with water. Measure the volume of water with the measuring cylinder.
- Temperature and Pressure measured using the thermometer and barometer respectively.

$$(c) P V = n R T = \frac{\text{mass}}{\text{Molar Mass}} R T$$

$$\text{Molar Mass} = \frac{(\text{mass})(R)(T)}{(P)(V)}$$

(d) If the liquid contains impurities then the mass used in the equation in (c) would be too large. Should be using a smaller number. This makes Molar Mass too large.