1 point

There are how many significant figures in the final answer for the following: 10555.33 - 9944.2 + 55.84 - 622.33 ?

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9 points

We react 88.8 g of $C_2H_5OH(l)$ and 88.8 g of $O_2(g)$ in a combustion reaction to produce $CO_2(g)$ and $H_2O(l)$. The combustion takes place in a steel container with a fixed volume of 10.0 L and the temperature is fixed at 25.00 °C. What mass of $CO_2(g)$ will we produce? Ignoring the pressures due to the vapours of the two liquids, $C_2H_5OH(l)$ and $H_2O(l)$, what is the total pressure before the reaction? And what is the total pressure after the reaction? Note that these two are not necessarily the same. Finally what is the average (or more precisely, root-mean-square) velocity of the $CO_2(g)$ molecules at the end?

1 point

An element has an average atomic mass of 83.00 u. It possesses two isotopes, one with an atomic mass of 82.00 u, and the other with an atomic mass of 85.00 u. What percentage of the atoms of this element have an atomic mass of 82.00 u?

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9 points

(a) (6 points) The percent composition of an unknown substance is 43.99% C, 21.31% O, 27.99% N, and 6.71% H. What is its empirical formula?

(b) (3 points) An oxyde of cobalt (a compound containing only Co and O) is 71.06% Co by mass. What is the empirical formula of this oxyde of cobalt?

1 point

If hypobromous acid is HOBr (or HBrO if you prefer), what is the precise chemical formula for the perbromate anion?

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9 points

(a) (6 points) In a 10.0 L steel container, we have 44.4 g of $CO_2(g)$, 44.4 g of $N_2(g)$, and 77.7 g of an unknown gas. The temperature is 25.0 °C and the total pressure is 8.888 atm. What is the molar mass of the unknown gas?

(b) (3 points) The density of a sample containing only $CO_2(g)$ is 0.777 g/L. The average (or root-mean-square) velocity of the $CO_2(g)$ molecules is 444.4 m/s. What is the pressure of the $CO_2(g)$ in this sample?

1 point

Give a balanced chemical equation for the combustion of $C_8H_6O_4(s)$ (combustion is the reaction of a substance with $O_2(g)$ to produce $CO_2(g)$ and $H_2O(l)$).

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9 points

(a) (3 points) With 20.00 kJ of heat, what mass of water can we heat from 20.0 °C to 65.0 °C.

(b) (6 points) We do the combustion of 18.8 L of ethane, $C_2H_6(g)$, at 25.0 °C and a constant pressure of 1.00 atm (N.B. combustion is the reaction of a substance with $O_2(g)$ to produce $CO_2(g)$ and $H_2O(l)$). What amount of heat is released by this combustion?

data

- ΔH_f° (C_2H_6, g) = -84.7 kJ mol^{-1}
- ΔH_f° (CO_2, g) = -393.5 kJ mol^{-1}
- ΔH_f° (H_2O, l) = -285.8 kJ mol^{-1}
- s (H_2O, l) = 4.184 J K^{-1} g^{-1}

1 point

Who discovered the charge/mass ratio of the electron?

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9 points

(a) (6 points) We place 100.0 g of a metal at 100.00 °C in 333.3 g of water at 20.00 °C. The water is in a beaker which is also at 20.00 °C. The specific heat capacity of water is 4.184 J K^{-1} g^{-1} and that of the metal is 0.555 J K^{-1} g^{-1}. We make the approximation that the heat capacity of the beaker is zero. What is the final temperature of the metal, the water, and the beaker?

(b) (3 points) The enthalpy of formation of $H_2O(l)$ is -285.8 kJ mol^{-1}. The enthalpy of vaporisation of $H_2O(l)$ is +44.0 kJ mol^{-1}. What is the value of ΔH for the reaction below?

$$2\ H_2O(g) \rightarrow 2\ H_2(g) + O_2(g)$$

The temperature is 25 °C.