***To receive full credit, please clearly show all work*** ***used to answer the following*.**

1. (a) The hydrocarbon fuels we have considered so far are saturated and called *alkanes*, having the general formula CnH2n+2 (*n* is an integer). Write an expression, in terms of numerical values with two significant figures and *n,* for the grams of CO2 produced when 1.0 g CnH2n+2 is combusted.

(b) One class of *unsaturated* hydrocarbon fuels is *alkenes*, having the general formula CnH2n. Write an expression, in terms of numerical values with two significant figures and *n,* for the grams of CO2 produced when 1.0 g CnH2n is combusted.

(c) For ***n* = 8**, calculate the ratio of your expression in (a) to your expression in (b).

2. A friend tells you that hydrocarbon fuels containing molecules of bigger molar mass liberate more heat per gram than those with smaller molar mass.

(a) Use the heats of combustion in the following table to determine whether this statement is true. Briefly explain your answer, including correct and relevant calculations.

| Hydrocarbon | Heat of Combustion |
| --- | --- |
| octane, C8H18 | −5070 kJ/mol |
| butane, C4H10 | −2658 kJ/mol |

1. Based on your results in part (a), do you expect the heat of combustion per gram of candle wax, C25H52, to be more or less than that of octane? Do you expect the molar heat of combustion of candle wax to be more or less than that of octane? (The “molar heat of combustion” is the heat of combustion per mole.) Justify your predictions.

3. Consider two different samples of gaseous fuels:

Sample A contains C4H10 Sample B contains C3H8

The samples have the same temperature and pressure. Use the ideal gas law to determine which sample has the larger density.

4. 435 kJ/mol is needed to eject electrons from mercury, i.e. the binding energy of an electron in mercury is 435 kJ/mol. (Note: 435 kJ/mol means it takes 435 kJ to eject a mole of electrons from Mercury. You can use Avagadro’s number to determine the binding energy for a single electron ejected from a single photon)

1. Can visible light cause electrons to eject from mercury? Briefly explain using a relevant calculation.

(b) An experiment is conducted in which radiation strikes the surface of a sample of mercury. Electrons are ejected, and the maximum velocity of these electrons is determined to be 6.7 x 105 m/s. What is the wavelength of the radiation being used in this experiment? (Please show your work.)