

## Quiz: Thermochemistry & Quantum Mechanics (Chapters 5 & 6)

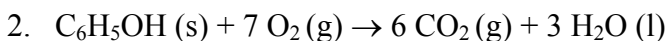
### AP Chem

### Version A (24 pts)

$$\Delta E = h\nu \quad c = \lambda\nu \quad E_n = \frac{-2.178 \times 10^{-18} \text{ joule}}{n^2} \quad q = mc\Delta T$$
$$c = 3.0 \times 10^8 \text{ m s}^{-1} \quad h = 6.63 \times 10^{-34} \text{ J s}$$

Complete on a separate sheet of paper. Show your work for all problems involving calculations and be sure to box your final answer and include sensible units.

1. (4 pts) 88.0 kg of Pb at 100.0°C are added to 300.0 g of 0.0°C water ( $c_{\text{water}} = 4.18 \text{ J/g}^\circ\text{C}$ ). If the final temperature of the Pb and water mixture is 10.0°C, what is the specific heat of Pb ( $c_{\text{Pb}}$ )?



(8 pts) When a 2.000 g sample of pure phenol,  $\text{C}_6\text{H}_5\text{OH(s)}$ , is completely burned according to the (balanced) equation above, 64.98 kilojoules of heat is released. Use the information in the table below to answer the questions that follow.

Substance	$\Delta H_f^\circ$ (kJ mol <sup>-1</sup> )
$\text{CO}_2 \text{ (g)}$	-393.5
$\text{H}_2\text{O (l)}$	-285.85
$\text{C}_6\text{H}_5\text{OH (s)}$	?

- a. (2 pts) Calculate the molar heat of combustion of phenol in kilojoules per mole.
- b. (6 pts) Calculate the standard heat of formation,  $\Delta H_f^\circ$ , of phenol in kilojoules per mole.
3. (6 pts) A certain line in the spectrum of atomic hydrogen is associated with the electronic transition of the H atom from the sixth energy level ( $n = 6$ ) to the third energy level ( $n = 3$ ).
- a. (4 pts) Calculate the change in energy, in J, associated with this electronic transition.
- b. (2 pts) Calculate the wavelength, in nm, of the radiation associated with the spectral line.
4. (6 pts) State whether the following quantum number sets are **permissible** (allowed) or **forbidden** (not allowed) and describe how you made your choice.
- a.  $n = 2, l = 1, m_l = -1$
- b.  $n = 3, l = 3, m_l = -2$
- c. (1, 0, 0)