REVIEW QUESTIONS
Test 2

1. A cylinder with a moving piston expands from an initial volume of 0.250 L against an external pressure of 2.00 atm. The expansion does 288 J of work on the surroundings. What is the final volume of the cylinder?

2. Manganese reacts with hydrochloric acid to produce manganese (II) chloride and hydrogen gas.

$$Mn\ (s)\ +\ 2\ HCl\ (aq)\ \rightarrow\ MnCl_2\ (aq)\ +\ H_2\ (g)$$

When 0.625 g of Mn is combined with enough HCl to make 100.0 mL of solution in a coffee-cup calorimeter, all of the Mn reacts, raising the temperature of the solution from 23.5°C to 28.8°C. Find ΔH_{rxn} for the reaction as written. (Assume specific heat and density of solution are the same as that of water).

3. The standard heat of reaction ($\Delta H°$) for the reaction shown below is –1985 kJ. Based on the $\Delta H°_f$ given for each substance, determine the $\Delta H°_f$ for C_3H_8O.

$$2\ C_3H_8O\ (l)\ +\ 9\ O_2\ (g) \rightarrow\ 6\ CO_2\ (g)\ +\ 8\ H_2O\ (l)$$

$\Delta H°_f$ (kJ/mol)	???	0	–394	–286

4. Find $\Delta H°$ (in kJ) for the reaction shown below:

$$3\ V_2O_3\ (s) \rightarrow V_2O_5\ (s) + 4\ VO\ (s)$$

from the following given reactions:

$4\ VO\ (s) + O_2\ (g) \rightarrow 2\ V_2O_3\ (s)$ $\Delta H° = -753$ kJ

$2\ V_2O_3\ (s) + O_2\ (g) \rightarrow 4\ VO_2\ (s)$ $\Delta H° = -452$ kJ

$4\ VO_2\ (s) + O_2\ (g) \rightarrow 2\ V_2O_5\ (s)$ $\Delta H° = -243$ kJ

5. Given the heat of reaction ($\Delta H°$) for the reaction shown below, what is $\Delta E°$ for this reaction?

$HCl\ (aq) + CaCO_3\ (s) \rightarrow CaCl_2\ (aq) + H_2O\ (l) + CO_2\ (g)$ $\Delta H° = -350.0$ kJ

6. Molybdenum metal has a threshold frequency of $1.09 \times 10^{15}\ s^{-1}$ before it can emit an electron from its surface by photoelectric effect. If Mo is radiated by a light with a wavelength of 120. nm, would it emit an electron? If so, what would be the maximum velocity of the electron emitted?

7. Calculate the wavelength of 50-g golf ball travelling at 400 m/s. (Calculate answer to 2 significant figures)

8. Neutron diffraction is an important technique for determining the structures of molecules. Calculate the velocity of a neutron with a wavelength of 0.088 nm. (mass of neutron = 1.675×10^{-24} g)

9. The heat of combustion of glucose is 15.57 kJ/g. A 2.500-g sample of glucose is burned in a bomb calorimeter containing 2.700 kg of water. The temperature of the calorimeter and the water increased from 20.55°C to 23.25°C. What is the heat capacity of the dry calorimeter?

10. When 2.00 g of HF gas is bubbled through 400. mL of water at 20.6°C, all the gas dissolves and the temperature of the solution rises to 24.3°C. What is the enthalpy change of solution (ΔH_{soln}) for HF? (Assume density and specific heat of solution to be the same as pure water)

11. The electron affinities (EA) for the elements from Al to Cl (in kJ/mol) are :

Al (–44) Si (–120) P (–74) S (–200.4) Cl (–348.7)

a) What is the general trend of EA among these atoms? Explain the reason for this trend.

b) Explain why phosphorous has a lower EA than Si.

12. Using data from your textbook, calculate the change in energy expected for each of the following processes:

a) $Na\,(g) + Cl\,(g) \rightarrow Na^{+}\,(g) + Cl^{-}\,(g)$

b) $Mg\,(g) + F\,(g) \rightarrow Mg^{+}\,(g) + F^{-}\,(g)$

c) $Mg^{+}\,(g) + F\,(g) \rightarrow Mg^{2+}\,(g) + F^{-}\,(g)$

Answers:

1. 1.67 L
2. –195 kJ
3. –1330 kJ/mol
4. +405 kJ
5. -352.5 kJ
6. 1.43×10^{6} m/s
7. 3.3×10^{-35} m
8. 4.5×10^{3} m/s
9. 3.13 kJ/°C
10. –62 kJ/mol
11. No answers provided
12. a) 147 kJ b) 410 kJ c) 1122 kJ