Multiple-Choice and Bimodal Questions

1) Calculate the kinetic energy in J of an electron moving at $6.00\times10^{6}\ \text{m/s}$. The mass of an electron is $9.11\times10^{-28}\ \text{g}$.

A) 4.98×10^{-48}
B) 3.28×10^{-14}
C) 1.64×10^{-17}
D) 2.49×10^{-48}
E) 6.56×10^{-14}

2) Calculate the kinetic energy in joules of an automobile weighing 2135 lb and traveling at 55 mph. (1 mile = 1.6093 km, 1lb = 453.59 g).

A) 1.2×10^{4}
B) 2.9×10^{5}
C) 5.9×10^{5}
D) 3.2×10^{6}
E) 3.2×10^{-6}

3) The kinetic energy of a 7.3 kg steel ball traveling at 18.0 m/s is _____ J.

A) 1.2×10^{3}
B) 66
C) 2.4×10^{3}
D) 1.3×10^{2}
E) 7.3

4) The ΔE of a system that releases 12.4 J of heat and does 4.2 J of work on the surroundings is _____ J.

A) 16.6
B) 12.4
C) 4.2
D) -16.6
E) -8.2

5) The change in the internal energy of a system that absorbs 2,500 J of heat and that does 7,655 J of work on the surroundings is _____ J.

6) The value of $\Delta H°$ for the reaction below is -72 kJ. _____ kJ of heat are released when 1.0 mol of HBr is formed in this reaction.

$$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$$

A) 144
B) 72
C) 0.44
D) 36
E) -72

7) The value of $\Delta H°$ for the reaction below is -126 kJ. _____ kj are released when 2.00 mol of NaOH is formed in the reaction?

$$2Na_2O_2(s) + 2H_2O(l) \rightarrow 4NaOH(s) + O_2(g)$$

A) 252
B) 63
C) 3.9
D) 7.8
E) -126

8) The value of $\Delta H°$ for the reaction below is -790 kJ. The enthalpy change accompanying the reaction of 0.95 g of S is _____ kJ.

$$2S(s) + 3O_2(g) \rightarrow 2SO_3(g)$$

A) 23
B) -23
C) -12
D) 12
E) -790

9) The value of $\Delta H°$ for the reaction below is -336 kJ. Calculate the heat (kJ) released to the surroundings when 23.0 g of HCl is formed.

$$CH_4(g) + 3Cl_2(g) \rightarrow CHCl_3(l) + 3HCl(g)$$

A) 177
B) 2.57×10^3
C) 70.7
D) 211
E) -336

10) The value of $\Delta H°$ for the reaction below is +128.1 kJ:

$$CH_3OH(l) \rightarrow CO(g) + 2H_2(g)$$

How many kJ of heat are consumed when 15.5 g of $CH_3OH(l)$ decomposes as shown in the equation?

A) 0.48
B) 62.0
C) 1.3×10^2
D) 32
E) 8.3

11) The value of $\Delta H°$ for the reaction below is +128.1 kJ:

$$CH_3OH(l) \rightarrow CO(g) + 2H_2(g)$$

How many kJ of heat are consumed when 5.10 g of $H_2(g)$ is formed as shown in the equation?

A) 162
B) 62.0
C) 128
D) 653
E) 326

12) The value of $\Delta H°$ for the reaction below is -1107 kJ:

$$2Ba(s) + O_2(g) \rightarrow 2BaO(s)$$

How many kJ of heat are released when 5.75 g of BaO(s) is produced?

A) 56.9
B) 23.2
C) 20.8
D) 193
E) 96.3

13) Given the following reactions:

$2S(s) + 3O_2(g) \rightarrow 2SO_3(g)$ ΔH = -790 kJ

$S(s) + O_2(g) \rightarrow SO_2(g)$ ΔH = -297 kJ

the enthalpy of the reaction in which sulfur dioxide is oxidized to sulfur trioxide

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

is _____ kJ.

A) 196
B) -196
C) 1087
D) -1384
E) -543

14) Given the following reactions

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ $\Delta H = 178.1$ kJ

$C(s, \text{graphite}) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393.5$ kJ

the enthalpy of the reaction

$$CaCO_3(s) \rightarrow CaO(s) + C(s, \text{graphite}) + O_2(g)$$

is _____ kJ.

A) 215.4
B) 571.6
C) -215.4
D) -571.6
E) 7.01×10^4

15) Given the following reactions

$N_2(g) + O_2(g) \rightarrow 2NO(g)$ $\Delta H = +180.7$ kJ

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ $\Delta H = -113.1$ kJ

the enthalpy for the decomposition of nitrogen dioxide into molecular nitrogen and oxygen

$$2NO_2(g) \rightarrow N_2(g) + 2O_2(g)$$

is _____ kJ.

A) 67.6
B) -67.6
C) 293.8
D) -293.8
E) 45.5

16) The value of $\Delta H°$ for the following reaction is -3351 kJ:

$$2Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$$

The value of $\Delta H_f°$ for $Al_2O_3(s)$ is _____ kJ.

A) -3351
B) -1676
C) -32.86
D) -16.43
E) +3351

17) Given the data in the table below, $\Delta H°_{rxn}$ for the reaction

$$Ca(OH)_2 + 2H_3AsO_4 \rightarrow Ca(H_2AsO_4)_2 + 2H_2O$$

is _____ kJ.

Substance	$\Delta H_f°$ (kJ/mol)
$Ca(OH)_2$	-986.6
H_3AsO_4	-900.4
$Ca(H_2AsO_4)_2$	-2346.0
H_2O	-285.9

A) -744.9
B) -4519
C) -4219
D) -130.4
E) -76.4

18) Given the data in the table below, $\Delta H°_{rxn}$ for the reaction

$$PCl_3(g) + 3HCl(g) \rightarrow 3Cl_2(g) + PH_3(g)$$

is _____ kJ.

Compound	$\Delta H_f°$ (kJ/mol)
PCl_3 (g)	-288.07
HCl (g)	-92.30
PH_3 (g)	5.40

A) -570.37
B) -385.77
C) 570.37
D) 385.77
E) The $\Delta H°_f$ of $Cl_2(g)$ is needed for the calculation.

19) A 25.5-g piece of cheddar cheese contains 37% fat, 28% protein, and 4% carbohydrate. The respective fuel values for protein, fat, and carbohydrate are 17, 38, and 17 kJ/g, respectively. The fuel value for this piece of cheese is _____ kJ.

A) 450
B) 330
C) 790
D) 99
E) 260

20) Objects can possess energy as _____.

(a) endothermic energy
(b) potential energy
(c) kinetic energy

A) a only
B) b only
C) c only
D) a and c
E) b and c

21) The internal energy of a system is always increased by _____.

A) adding heat to the system
B) having the system do work on the surroundings
C) withdrawing heat from the system
D) adding heat to the system and having the system do work on the surroundings
E) a volume compression

22) Which one of the following conditions would always result in an increase in the internal energy of a system?

A) The system loses heat and does work on the surroundings.
B) The system gains heat and does work on the surroundings.
C) The system loses heat and has work done on it by the surroundings.
D) The system gains heat and has work done on it by the surroundings.
E) None of the above is correct.

23) When a system _____, ΔE is <u>always</u> negative.

A) absorbs heat and does work
B) gives off heat and does work
C) absorbs heat and has work done on it
D) gives off heat and has work done on it
E) none of the above is <u>always</u> negative.

24) Which one of the following is an endothermic process?

A) ice melting
B) water freezing
C) boiling soup
D) Hydrochloric acid and barium hydroxide are mixed at 25 °C: the temperature increases.
E) Both A and C

25) Of the following, which one is a state function?

A) H
B) q
C) w
D) heat
E) none of the above

26) Which of the following is a statement of the first law of thermodynamics?

A) $E_k = \frac{1}{2}mv^2$
B) A negative ΔH corresponds to an exothermic process.
C) $\Delta E = E_{final} - E_{initial}$
D) Energy lost by the system must be gained by the surroundings.
E) 1 cal = 4.184 J (exactly)

27) A _____ ΔH corresponds to an _____ process.

A) negative, endothermic
B) negative, exothermic
C) positive, exothermic
D) zero, exothermic
E) zero, endothermic

28) Given the equation

$$H_2O(l) \rightarrow H_2O(g) \quad \Delta H_{rxn} = 40.7 \text{ kJ at } 100\ ^\circ\text{C}$$

Calculate the mass of liquid water (in grams) at 100 °C that can converted to vapor by absorbing 2.400 kJ of heat.