Exam

Name_____

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

1) At what velocity (m/s) must a 20.0 g object be moving in order to possess a kinetic energy of 1.00 J? 1) _____
A) $100 \times 10^2$ B) 1.00 C) 10.0 D) $1.00 \times 10^3$ E) 50.0

2) The internal energy of a system is always increased by _____. 2) _____
A) adding heat to the system
B) adding heat to the system and having the system do work on the surroundings
C) withdrawing heat from the system
D) having the system do work on the surroundings
E) a volume compression

3) Which one of the following conditions would always result in an increase in the internal energy of a system? 3) _____
A) The system gains heat and has work done on it by 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 loses heat and does work on the surroundings.
E) None of the above is correct.

4) The value of $\Delta E$ for a system that performs 13 kJ of work on its surroundings and loses 9 kJ of heat is _____ kJ. 4) _____
A) –13 B) 22 C) –22 D) 4 E) –4

5) Which one of the following is an endothermic process? 5) _____
A) Both A and C
B) water freezing
C) ice melting
D) boiling soup
E) Hydrochloric acid and barium hydroxide are mixed at 25 °C: the temperature increases.

6) Of the following, which one is a state function? 6) _____
A) w
B) H
C) q
D) heat
E) none of the above

7) The internal energy can be increased by _____. 7) _____

(a) transferring heat from the surroundings to the system
(b) transferring heat from the system to the surroundings
(c) doing work on the system

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

8) A _____ $\Delta H$ corresponds to an _____ process. 8) _____

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

9) For a given process at constant pressure, $\Delta H$ is negative. This means that the process is _____. 9) _____

A) endothermic
B) a state function
C) equithermic
D) energy
E) exothermic

10) Which of the following statements is false? 10) _____

A) The enthalpy change for a reaction is equal in magnitude, but opposite in sign, to the enthalpy change for the reverse reaction.
B) Enthalpy is an intensive property.
C) The enthalpy change for a reaction depends on the state of the reactants and products.
D) Internal energy is a state function.
E) The enthalpy of a reaction is equal to the heat of the reaction.

11) A chemical reaction that releases heat to the surroundings is said to be _____ and has a _____ $\Delta H$ at constant pressure. 11) _____

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

12) Under what condition(s) is the enthalpy change of a process equal to the amount of heat transferred or out of the system? 12) _____

(a) temperature is constant
(b) pressure is constant
(c) volume is constant

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

13) The units of of specific heat are _____. 13) _____

A) J/g–K or J/g–°C
B) g–K/J or g–°C/J
C) J/K or J/°C
D) K/J or °C/J
E) J/mol

14) A sample of calcium carbonate [$CaCO_3$ (s)] absorbs 45.5 J of heat, upon which the temperature of the sample increases from 21.1 °C to 28.5 °C. If the specific heat of calcium carbonate is 0.82 J/g–K, what is the mass (in grams) of the sample? 14) _____

A) 410 B) 5.0 C) $5.0 \times 10^3$ D) 7.5 E) 3.7

15) An 8.29 g sample of calcium carbonate [$CaCO_3$ (s)] absorbs 50.3 J of heat, upon which the temperature of the sample increases from 21.1 °C to 28.5 °C. What is the specific heat of calcium carbonate? 15) _____

A) 2.2 B) 1.1 C) .63 D) 4.2 E) .82

16) The temperature of a 35.2 g sample of iron increases from 23.7 °C to 29.5 °C. If the specific heat of iron is 0.450 J/g–K, how many joules of heat are absorbed? 16) _____

A) 0.450 B) 92 C) $1.1 \times 10^3$ D) 4.3 E) 1100

17) Which of the following is a statement of Hess's law? 17) _____

A) If a reaction is carried out in a series of steps, the ΔH for the reaction will equal the product of the enthalpy changes for the individual steps.
B) The ΔH for a process in the forward direction is equal to the ΔH for the process in the reverse direction.
C) The ΔH of a reaction depends on the physical states of the reactants and products.
D) If a reaction is carried out in a series of steps, the ΔH for the reaction will equal the sum of the enthalpy changes for the individual steps.
E) The ΔH for a process in the forward direction is equal in magnitude and opposite in sign to the ΔH for the process in the reverse direction.

18) Of the following, $\Delta H_f^\circ$ is <u>not</u> zero for _____. 18) _____

A) $F_2$ (s)
B) $N_2$ (g)
C) C (graphite)
D) $O_2$ (g)
E) $Cl_2$ (g)

19) Consider the following two reactions: 19) _____

$A \rightarrow 2B \qquad \Delta H^\circ_{rxn} = 456.7$ kJ/mol
$A \rightarrow C \qquad \Delta H^\circ_{rxn} = -22.1$kJ/mol

Determine the enthalpy change for the process:

$2B \rightarrow C$

A) 478.8 kJ/mol
B) 434.6 kJ/mol
C) –478.8 kJ/mol
D) –434.6 kJ/mol
E) More information is needed to solve the problem.

20) For the species in the reaction below, $\Delta H_f^\circ$ is zero for _____. 20) _____

$$2Co\ (s) + H_2\ (g) + 8PF_3\ (g) \rightarrow 2HCo(PF_3)_4\ (l)$$

A) $HCo(PF_3)_4$ (l)
B) Co (s)
C) $PF_3$ (g)
D) $H_2$ (g)
E) both Co(s) and $H_2$ (g)

21) For which one of the following reactions is the value of $\Delta H^\circ_{rxn}$ equal to $\Delta H_f^\circ$ for the product? 21) _____

A) $C_2H_2$ (g) + $H_2$ (g) → $C_2H_4$ (g)
B) 2Ca (s) + $O_2$ (g) → 2CaO (s)
C) 2C (graphite) + $O_2$ (g) → 2CO (g)
D) 3Mg (s) + $N_2$ (g) → $Mg_3N_2$ (s)
E) C (diamond) + $O_2$ (g) → $CO_2$ (g)

22) For which one of the following reactions is the value of $\Delta H^\circ_{rxn}$ equal to $\Delta H^\circ_f$ for the product? 22) _____

A) $N_2$ (g) + $O_2$ (g) → 2 NO (g)
B) $H_2O$ (l) + 1/2 $O_2$ (g) → $H_2O_2$ (l)
C) 2 $H_2$ (g) + $O_2$ (g) → 2 $H_2O$ (l)
D) 2 $H_2$ (g) + $O_2$ (g) → 2 $H_2O$ (g)
E) none of the above

23) With reference to enthalpy changes, the term standard conditions means _____. 23) _____

(a) P = 1 atm
(b) some common temperature, usually 298 K
(c) V = 1 L

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

24) Fuel values of hydrocarbons increase as the H/C atomic ratio increases. Which of the following compounds has the highest fuel value? 24) _____

A) $C_2H_6$ B) $C_2H_4$ C) $C_6H_6$ D) $CH_4$ E) $C_2H_2$

25) Which one of the choices below is <u>not</u> considered a fossil fuel? 25) _____

A) anthracite coal
B) natural gas
C) crude oil
D) hydrogen
E) petroleum