Name: KEY

* with explanations!

Chapter 17 Mixed Review

Match each item with the correct statement below.

a. heat of reaction
b. heat of formation
c. exothermic reaction
d. heat of fusion
e. heat of solution
f. heat of vaporization
g. heat of condensation
h. heat capacity
i. specific heat
j. endothermic reaction

1. A the enthalpy change for a chemical reaction exactly as it is written

2. E the enthalpy change caused by dissolving a substance

3. D the energy required to melt a solid at its melting point

4. B the change in enthalpy that accompanies the formation of a compound from its elements

5. C a chemical reaction that gives off heat

6. J a chemical reaction that absorbs heat

7. F the energy required to turn a liquid into a gas

8. G the energy given off when a gas turns into a liquid

9. H The amount of heat needed to increase the temperature of an object exactly 1°C

10. I The amount of heat needed to increase the temperature of 1 g of a substance 1°C

Classify each of these statements as true or false.

T **11.** $\Delta H_{fus} = -\Delta H_{solid}$

F **12.** Melting and vaporization are exothermic processes. They are endo b/c you need to add heat to melt/vaporize.

T **13.** In order to convert 1 mole of $H_2O(l)$ to 1 mol of $H_2O(g)$, 40.7 kJ must be supplied.
↳ ΔH_{vap} of water (in book)

F **14.** As ice melts, the temperature of the ice increases until the entire sample becomes liquid. It stays constant when changing phases

F **15.** When ammonium nitrate dissolves in water, the solution gets cold. This is an example of an exothermic reaction. False → an exothermic reaction giving off heat will feel hot

T **16.** The sign of ΔH is negative for an exothermic reaction.
↳ exo = -q

T **17.** If 129 kJ of heat is required to decompose 2 moles of $NaHCO_3$, then 258 kJ is required to decompose 4 moles of $NaHCO_3$.

If 2 mol makes 129 kJ,
4 mol will make double: 258 kJ

F **18.** The physical state of the reactants and products in a thermochemical reaction are not important when calculating ΔH of the reaction. Yes they are!

T **19.** In endothermic reactions, the potential energy of the product(s) is higher than the potential energy of the reactants. kJ E + A + B → C + D C+D have that E split b/w them

T **20.** The equation $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s)$ $\Delta H = 65.2$ kJ is an example of a thermochemical equation. need states of matter & ΔH for a thermochemical eq.

→ giving off heat

21. In an exothermic reaction, the energy stored in the chemical bonds of the reactants is B.
   a. equal to the energy stored in the bonds of the products
   b. greater than the energy stored in the bonds of the products
   c. less than the energy stored in the bonds of the products
   d. less than the heat released

A+B → C+D+E
E is lost from system so original reactants had higher E in bonds before they reacted & lost it

22. A process that releases heat is a(n) B.
   a. polythermic process
   b. exothermic process
   c. ectothermic process
   d. endothermic process

23. What is the amount of heat required to raise the temperature of 200.0 g of aluminum by 10°C? (specific heat of aluminum = 0.21cal/ g C) q=? m ΔT C
   a. 420 cal
   b. 4200 cal
   c. 42,000 cal
   d. 420,000 cal

$q = C \times m \times \Delta T$
$= 0.21 \text{ cal/g°C} \times 200 \text{ g} \times 10 \text{°C}$
$= 420 \text{ cal}$

24. Which of the following is a valid unit for specific heat?
   a. $\frac{cal}{g°C}$ or $\frac{J}{g°C}$
   b. cal
   c. $\frac{cal}{g}$
   d. °C

C=? m q ΔT
25. How can you describe the specific heat of olive oil if it takes approximately 420 J of heat to raise the temperature of 7 g of olive oil by 30°C?
   a. greater than the specific heat of water
   b. less than the specific heat of water
   c. equal to the specific heat of water
   d. Not enough information is given.

$C = \frac{q}{m \times \Delta T}$
$= \frac{420 \text{ J}}{7 \text{ g} \times 30 \text{°C}}$
$= 2 \text{ J/g°C}$
vs water
$= 4.18 \text{ J/g°C}$

26. What does the symbol ΔH stand for?
   a. the specific heat of a substance
   b. the heat capacity of a substance
   c. the heat of reaction for a chemical reaction or change in enthalpy
   d. one Calorie given off by a reaction

27. What is the standard heat of reaction for the following reaction?

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

(ΔH_f^0 for Cu^{2+} = +64.4 kJ/mol; ΔH_f^0 for Zn^{2+} = –152.4 kJ/mol)

64.4 kJ/mol
−152.4 kJ/mol
−88 kJ/mol

a. 216.8 kJ released per mole
c. 88.0 kJ absorbed per mole
(b.) 88.0 kJ released per mole
d. 216.8 kJ absorbed per mole

→ exothermic or −ΔH

28. Which of the following is NOT a form of energy?

a. light
c. heat
(b.) pressure
d. electricity

29. Which of the following is transferred due to a temperature difference?

a. chemical energy
c. electrical energy
b. mechanical energy
(d.) heat

C → $\frac{J}{g°C}$

30. The specific heat capacity of graphite is 0.71 $\frac{J}{g°C}$. Calculate the energy required to raise the temperature of 750 g of graphite by 160°C

q = ? m ΔT

$q = C \times m \times \Delta T$

$q = 0.71\ J/g°C \times 750\ g \times 160°C$

$= 85200\ J$

don't need to do ★ these on quiz

31. How much heat is released when 50g of ammonia (NH_3) freezes? → $\Delta H_{solid} = \Delta H_{fus}$ for ammonia is in book on page 571

$$50\ g\ NH_3 \left| \frac{1\ mol\ NH_3}{17.0\ g\ NH_3} \right| \frac{5.66\ kJ}{1\ mol\ NH_3} = -16.65\ kJ$$

32. How much heat is required to raise the temperature of 8.4×10^2 g of aluminum by 42°C? (specific heat of aluminum = 0.21 cal /gC)

q = ? m ΔT C

$q = C \times m \times \Delta T$

$q = 0.21\ cal/g°C \times 8.4 \times 10^2\ g \times 42°C = 7408.8\ cal$

33. If 500 g (m) of iron absorbs 22,000 cal (q) of heat, what will be the change in temperature? (specific heat of iron = 0.11 cal/g C) (ΔT = ?)

$\Delta T = \frac{q}{m \times C}$

$$\Delta T = \frac{22000\ cal}{500\ g \times 0.11\ cal/g^{\circ}C} = \boxed{400\ ^{\circ}C}$$

34. When ethanol, $C_2H_6O(l)$, burns, it reacts with $O_2(g)$ to produce $CO_2(g)$ and $H_2O(l)$ and 1368kJ of heat is released. Write the balanced thermochemical equation for this reaction.

$$C_2H_6O(l) + O_2(g) \longrightarrow CO_2(l) + H_2O(l) + 1368\ kJ$$

*this equation is unbalanced

*35. How much heat is absorbed when 63.7 g of $H_2O(l)$ at 100°C and 101.3kPa is converted to gas at 100°C? Express your answer in kJ. ΔH_{vap} = 40.7kJ/mol

won't see these Q's on quiz

$$63.7\ g\ H_2O \left| \frac{1\ mol\ H_2O}{18.0\ g\ H_2O} \right| \frac{40.7\ kJ}{1\ mol\ H_2O} = \boxed{144\ kJ}$$

*36. How many kilojoules of heat is absorbed when 0.46g of chloroethane (C_2H_5Cl, bp 12.3°C) vaporizes at its normal boiling point? The molar heat of vaporization of chloroethane is 24.7kJ/mol.

$$0.46\ g\ C_2H_5Cl \left| \frac{1\ mol\ C_2H_5Cl}{64\ g\ C_2H_5Cl} \right| \frac{24.7\ kJ}{1\ mol\ C_2H_5Cl} = \boxed{0.18\ kJ}$$