6 • Energy and Chemical Reactions

PRACTICE TEST ANSWERS

D 1) $37.7\,cal \times \frac{4.184\,J}{1\,cal} = 157.7 \approx \boxed{158\,J}$

A 2) $\frac{J}{^\circ C}$ = heat capacity

assume any mass ... 1 g

A 3) A $\frac{25\,J}{1g \cdot 4^\circ C} = 6.25\,\frac{J}{g^\circ C}$ | B $\frac{25\,J}{1g \cdot 8^\circ C} = 3.13\,\frac{J}{g^\circ C}$

A is twice as difficult to heat up as B

D 4) $\frac{25\,J}{5.0g \cdot 2^\circ C} = \boxed{2.5\,\frac{J}{g^\circ C}}$

B 5) $q = mc\Delta T = (2.00g)(.902\,\frac{J}{g^\circ C})(5.0^\circ C) = \boxed{9.02\,J}$

D 6) Heat is ABSORBED = ENDOTHERMIC ΔH ⊕

D 7) Step 1 ↑40 ↑40 Step 2 ↓30 ↓70 $\boxed{\Delta E = \text{ZERO}}$

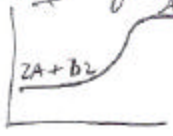
B 8) Hot = exothermic (ENERGY of universe is constant)

D 9) Form FROM ITS ELEMENTS $N_2 + \frac{3}{2}O_2 \rightarrow N_2O_3$

A 10) ΔH ⊕ ∴ ENDOTHERMIC

~~D~~ surrounding LOSE energy

~~C~~ ΔH_f of AB is +50.0 kJ

~~D~~ 

AB has MORE energy (PE) than $A_2 + B_2$

D 11) $C_3H_6 + \frac{9}{2}O_2 \rightarrow 3CO_2 + 3H_2O$

$3C + 3H_2 \rightarrow C_3H_6 \quad -(+53.3\ kJ)$

↪

$(C_{(s)} + O_2 \rightarrow CO_2) \times 3 \quad 3\times(-394\ kJ)$

$(H_2 + \frac{1}{2}O_2 \rightarrow H_2O) \times 3 \quad 3\times(-286)$

or SHORTCUT

$\Delta H_{rxn} = 3(\Delta H_f CO_2) + 3(\Delta H_f H_2O) - \Delta H_f C_3H_6$

$= 3(-394) + 3(-286) - 53.3$

$= -2093.3 \approx \boxed{-2090\ kJ}$

D 12) $O_{2(g)} \rightarrow O_{2(g)} \quad \Delta H = 0$

(same)

D 13) ~~$TiCl_{4(l)} \rightarrow TiCl_{4(g)}$~~

~~$Ti + 2Cl_2 \rightarrow TiCl_{4(l)} \quad -804.2\ kJ$~~

↪ $TiCl_{4(l)} \rightarrow Ti + 2Cl_2 \quad +804.2\ kJ$

~~$TiCl_{4(g)} \rightarrow 2Cl_{2(g)} + Ti_{(s)} \quad 763.2\ kJ$~~

↪ $2Cl_2 + Ti \rightarrow TiCl_{4(g)} \quad -763.2\ kJ$

TURN BOTH EQUATION AROUND

$\Delta H = \begin{array}{r} 804.2 \\ -763.2 \\ \hline \end{array}$

$\boxed{41.0\ kJ}$

A 14) $D + F \rightarrow G + M$

~~$G + C \rightarrow A + B$~~ $+277$ — Reverse this

~~$G + F \rightarrow A$~~ $+303$

$D \rightarrow B + M$ -158

~~$A + B \rightarrow C + G$~~ -277

$\Delta H = -132$ kJ

A 15) SHORTCUT: $\Delta H_{rxn} = \Delta H_f N_2O_4 + \Delta H_f NO_2 - 3(\Delta H_f NO)$

$= 82.1 + 34.0 - 3(90)$

$= -153.9$ kJ

B 16) SHORTCUT

$\Delta H_{combustion} = 2(\Delta H_f CO_2) + 3(\Delta H_f H_2O) - \Delta H_f C_2H_5OH$

$-1277.3 = 2(-393.5) + 3(-241.8) - x$

$x = 2(-393.5) + 3(-241.8) + 1277.3$

$= -787.0 - 725.4 + 1277.3$

$= -235.1$ kJ

B 17) $25.0\text{g ice} \times \frac{333\text{ J}}{1\text{ g ice}} \times \frac{1\text{ kJ}}{1000\text{ J}} = 8.325\text{ kJ} = \boxed{8.33\text{ kJ}}$

18) $\Delta T_{H_2O} = 24.8 - 19.2^\circ C = \boxed{5.6^\circ C}$

$\Delta T_{Beads} = 24.8 - 89.2^\circ C = \boxed{-64.4^\circ C}$ ← 2 sig figs.

19) $q = mc\Delta T = (10.14\text{g})(4.184\ \frac{J}{g^\circ C})(5.6^\circ C) = 237.58 = \boxed{240\text{ J}}$

$q_{Beads} = -q_{water} = \boxed{-240\text{ J}}$

20) $q_{Beads} = m\ c\ \Delta T \quad \therefore -240\text{ J} = (4.88\text{g})(x)(-64.4^\circ C)$

$x = .76366 = \boxed{.76\ \frac{J}{g^\circ C}}$

% error $= \frac{.833 - .76}{.833} \times 100 = \boxed{8.8\%}$