ANSWERS

[redacted]

Name____________

Period____________

[redacted]

Conversions

1. If a beaker gained 4.59×10^7 joules, how many
   a. calories did it gain? (lower case c)

   $4.59\times10^7 \text{ joules} \times \left(\frac{1.00 \text{ calories}}{4.18 \text{ joules}}\right) = 10980861 \text{ calories}$

   b. Calories did it gain? (upper case C)

   $4.59\times10^7 \text{ joules} \times \left(\frac{1.00 \text{ calories}}{4.18 \text{ joules}}\right)\left(\frac{1 \text{ Calories}}{1000 \text{ calories}}\right) = 10981 \text{ Calories}$

Q=mc ΔT Type Problems

Instructions: For the formula **Q=mc ΔT** fill in the parentheses at right. Fill in (a) with the words such as "change of temperature", "heat", "specific heat", and "mass" Fill in (b) with the units, such as "grams", "joules", "°C", and $\frac{joules}{g\cdot°C}$	a) (heat) = (mass) (spec. heat) (change temp.) b) [J] = [g] [$\frac{J}{g\cdot°C}$] [°C]

Fill in blank with whichever is more appropriate, 'specific heat' or 'heat'

2. heat Q stands for this in the formula **Q=m C ΔT**.
3. Spec. heat C stands for this in the formula **Q=m C ΔT**
4. spec. heat This is a constant number for a given substance.
5. heat This is sometimes measured in joules
6. Spec. ht This is sometimes measured in $\frac{J}{g\cdot°C}$
7. heat This is sometimes measured in calories

8. How much heat will raise a pot of 500. g of water from 26. °C to 90. °C?

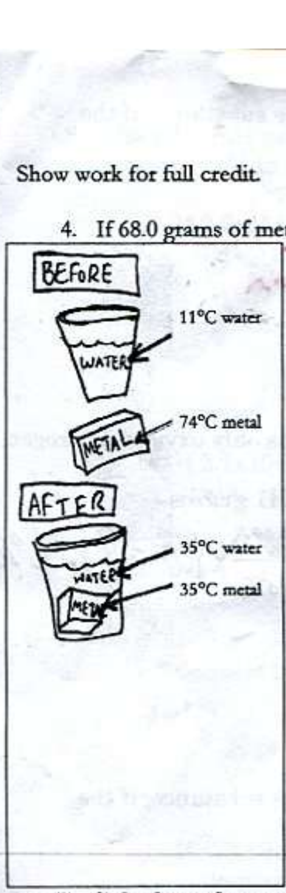
$Q = (500 g)(4.18)(64°c)$

$Q = 133760$ joules

Story problem	calculate $\Delta T = T_{final} - T_{initial}$	Write the formula $Q=mc\Delta T$ and rearrange it to get the unknown by itself	plug in numbers and solve
What is the specific heat of silicon if it takes 384J to raise the temperature of 45.0g of Si from 23.00°C to 35.00?	$\Delta T = 35-23 = 12°$	$Q = m c \Delta T$ $C = \frac{Q}{m\Delta T}$	$C = \frac{(384 J)}{(45.0 g)(12°c)}$ $C = 0.711 \frac{J}{g \cdot °c}$
If a copper hammer gains 24,881 joules of heat while its temperature goes from 13°C to 71°C, what is the hammer's mass? The specific heat of copper is 0.385 J/g°C.	$\Delta T = 71-13°c$ $\Delta T = 58°c$	$Q = m c \Delta T$ $m = \frac{Q}{C\Delta T}$	mass $= \frac{(24881 J)}{(0.385 \frac{J}{g°c})(58°c)}$
A metal coin absorbed 656.04 calories of heat. What was the mass of the coin if the initial temperature was 25°C and the final temperature was 86°C? The specific heat of copper is 0.092 cal/g°C…	$\Delta T = 86°c - 25°c$ $\Delta T = 61°c$	$Q = m c \Delta T$ $m = \frac{Q}{C\Delta T}$	$m = \frac{(656.04 cal)}{(0.092 \frac{cal}{g°c})(61°c)}$ $m = 120$ grams

Show work for full credit.

4. If 68.0 grams of metal were dropped into 171 grams of water calculate the following



a) Find ΔT for the water.

$\Delta T = 35^\circ c - 11^\circ c$

$\Delta T = 24^\circ C$

b) How many joules of heat entered the water?

Use $Q = m\ C\ \Delta T$

$Q = (171g)(4.18\frac{J}{g^\circ c})(24^\circ C)$

$Q = 17155\ J \approx 17000$ joules

c) How many joules of heat heat left the metal? ← same as what entered the water

d) Calculate the specific heat of the metal.

rearrange first: $Q = m C \Delta T$

$\frac{Q}{m\ \Delta T} = C$

$\frac{(17155J)}{(68.0g)(39^\circ c)} = C$

$6.5\frac{J}{g^\circ c} = C$ ← units: $\frac{\text{joules}}{\text{gram} \cdot \text{degree}}$

5. **Solve the following questions for a certain substance that contains only oxygen, hydrogen, and carbon, in the following amounts:**
Carbon: 34.00grams Hydrogen: 5.22 grams Oxygen: 11.04 grams
a. Find the percent oxygen by mass

first find total mass: $34.00g + 5.22g + 11.04g = 50.26g$

$\% = \frac{\text{grams oxygen}}{\text{grams total}} \times 100$

$\% = \frac{11.04g}{50.26g} \times 100$ $\% = 21.96$

b. How much oxygen would be in a larger sample of this same substance, if the sample's total mass was 400. grams?

Lonely number!

$$400.\text{ g total} \times \left(\frac{11.04 \text{ grams oxygen}}{50.26 \text{ grams total}}\right) = 87.9 \text{ grams oxygen}$$

6. Solve the following questions for a certain substance that contains only oxygen, hydrogen, and carbon, in the following amounts:

Carbon: 44.06grams Hydrogen: 6.20 grams Oxygen: 13.41 grams

a. Find the percent oxygen by mass

$$\frac{\text{stuff you're interested in}}{\text{total stuff}} \times 100 = \%$$

Second: $\frac{13.41 \text{ g oxygen}}{63.67 \text{ g total}} \times 100 = 21.06\%$

First: 44.06 grams + 6.20 g + 13.41 g = 63.67 grams

b. How much oxygen would be in a larger sample of this same substance, if the sample's total mass was 690. grams?

Lonely unit.

$$690.\text{ grams total} \times \left(\frac{13.41 \text{ oxygen grams}}{63.67 \text{ grams total}}\right) = 145 \text{ oxygen grams}$$

c. If you obtained a sample of this same substance that contained 84.2 grams of oxygen, how large would that sample's total mass be?

Lonely number!

$$84.2 \text{ grams Oxygen} \times \left(\frac{63.67 \text{ grams total}}{13.41 \text{ grams oxygen}}\right) = 400.\text{ grams total}$$

7. List the seven elements that exist as diatomic molecules:

H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2

8. The following questions all relate to the reaction where hydrogen (H_2) reacts with nitrogen (N_2) to form ammonia (NH_3) according to this recipe:

$$3H_2 + 1N_2 \rightarrow 2NH_3$$

a. If 2.7×10^{18} molecules of H_2 reacted, how many molecules of N_2 would react?

Lonely unit!

$$2.7 \times 10^{18} \text{ molecules } H_2 \times \left(\frac{1 \text{ molecules } N_2}{3 \text{ molecules } H_2} \right) =$$

answer: 9.0×10^{17}

b. If 2.7×10^{18} molecules of H_2 reacted, how many molecules of NH_3 would form?

Lonely unit

$$2.7 \times 10^{18} H_2 \text{ molecules} \times \left(\frac{2 \; NH_3 \text{ molecules}}{3 \; H_2 \text{ molecules}} \right) = 1.8 \times 10^{18} \text{ molecules } H_2$$

c. Convert 2.7×10^{18} molecules of H_2 into moles of H_2

$$2.7 \times 10^{18} \text{ molecules } H_2 \times \left(\frac{1.00 \text{ moles } H_2}{6.02 \times 10^{23} \text{ molecules } H_2} \right) = 4.5 \times 10^{-6} \text{ moles } H_2$$

d. If you had 355 molecules of NH_3, how many atoms of hydrogen are in those molecules all together?

$$355 \text{ molecules } NH_3 \times \left(\frac{3 \; H \text{ atoms}}{1 \; NH_3 \text{ molecule}} \right) = 1065 \text{ hydrogen atoms}$$

e. If you had 6934 atoms of nitrogen, how many molecules of nitrogen could you form?

$$6934 \text{ atoms Nitrogen} \times \left(\frac{1 \text{ molecules nitrogen}}{2 \text{ atoms nitrogen}} \right) = 3467 \text{ molecules nitroge}$$

f. If 7.7×10^{18} molecules of N_2 reacted, how many molecules of NH_3 would form?

$$7.7 \times 10^{18} \text{ molecules } N_2 \times \left(\frac{2 \text{ molecules } NH_3}{1 \text{ molecules } N_2} \right) = 1.5 \times 10^{19} \text{ molecules } NH_3$$

g. Convert 7.7×10^{14} molecules of H_2 into moles of H_2

$$7.7 \times 10^{14} \text{ molecules } H_2 \times \left(\frac{1.00 \text{ MOLES } H_2}{6.02 \times 10^{23} \text{ molecules } H_2} \right) = 1.3 \times 10^{-9} \text{ moles } H_2$$