How many joules of energy does it take to warm up 535 grams of very cold ice from -18.5°C to -10.8°C?

The H_F for H_2O is 334 J/g and the C_{ICE} = 2.10 J/g·K

A balanced thermochemical reaction:

$N_{2(G)} + O_{2(G)} + 182.6\ kJ \rightarrow 2NO_{(G)}$

How many kilojoules of energy are absorbed when only 0.75 moles of $NO_{(G)}$ form?

1 ANSWER

How many joules oes it take to warm up 535 g very cold ice from -18.5°C to -10.8°C?

The H_F for H_2O is 334 J/g and the C_{ICE} = 2.10 J/g·K

$$q = mC\Delta T$$

$$q = (535\ g)(2.10\ J/g\cdot K)(7.70\ K)$$

$$q = 8650\ J \quad (3\ SF)$$

2 ANSWER

A balanced thermochemical reaction:

$$N_{2(G)} + O_{2(G)} + 182.6\ kJ \rightarrow 2NO_{(G)}$$

How many kilojoules of energy are absorbed when 0.75 moles of $NO_{(G)}$ form?

$$\text{MR} \quad \frac{\text{NO}}{\text{energy}} \quad \frac{2}{182.6\ kJ} \quad \frac{0.75}{X\ kJ}$$

2X = (182.6 kJ)(0.75)

2X = 136.95

X = 68 kJ (2 SF)

3

How many joules of energy must be removed from 1225 mL of $H_2O_{(L)}$ at 273 K to form 1225 grams $H_2O_{(S)}$?

4

If you dissolve 90.3 g $NaOH_{(S)}$ (at 21.5°C) into 567 mL of pure water also at this temperature, what would be the likely temperature this solution would be soon after stirring?

21.5°C   20.5°C   23.5°C   273 K

3 ANSWER

How many joules of energy must be removed from 1225 mL of $H_2O_{(L)}$ at 273 K to form 1225 grams $H_2O_{(S)}$?

$$q = mH_F$$

$$q = (1225\ g)(334\ J/g)$$

$$q = 409{,}200\ J \quad (4SF)$$

4 ANSWER

If you dissolve 90.3 g $NaOH_{(S)}$ (at 21.5°C) into 567 mL of pure water also at this temperature, what is the only possible temperature that this solution would be at immediately after stirring?

Table I shows us that the process of dissolving NaOH into water is exothermic. Exothermic processes release heat energy, so the solution would be HOTTER. Only a hotter temperature could be correct: 23.5°C

For each of these statements, which is endothermic or exothermic.

- Ice melts
- Steam condenses
- Water freezes
- Copper warms
- Ethanol boils

6

If you dissolve potassium nitrate into room temperature water, will the solution feel the same, or will it feel colder or will it feel warmer?

5 ANSWER

Which is endothermic or exothermic?

- Ice melts (requires heat, endothermic)
- Steam condenses (emits heat, exothermic)
- Water freezes (gives off heat, exothermic)
- Copper warms (requires heat, endothermic)
- Ethanol boils (requires heat, endothermic)

6 ANSWER

If you dissolve potassium nitrate into
room temperature water, will the solution feel the same,
or will it feel colder or will it feel warmer?

On table I, when KNO_3 dissolves into water, the ΔH is +34.89 kJ.

$+\Delta H$ = endothermic.

Endothermic processes absorb energy, it would be colder.

7

When 68.0 grams of pure iron absorbs 675 J of energy, the temperature changes from 19.6°C to 41.6°C. Calculate the C of Fe.

Convert 1895 Calories into Joules.

7 ANSWER

When 68.0 grams of iron absorbs 675 J of energy, the temp changes from 19.6°C to 41.6°C. Calculate the C of Fe.

$$q = mC\Delta T$$

$$675 \text{ J} = (68.0 \text{ g})(C)(22.0 \text{ K})$$

$$\frac{675 \text{ J}}{(68.0 \text{ g})(22.0 \text{ K})} = C$$

$$0.451 \text{ J/g·K} = C \quad \text{(3 SF)}$$

8 ANSWER

Convert 1895 Calories into Joules?

$$\frac{1895\ C}{1} \times \frac{1000\ cal}{1\ C} = 1{,}895{,}000\ cal$$

$$\frac{1{,}895{,}000\ cal}{1} \times \frac{4.18\ Joules}{1\ cal} = 7{,}921{,}000\ Joules$$

(4 SF)

At what temperature (°C) would you use the $q = mH_F$ formula for aluminum?

10

454 grams of Bismuth (☺) will change temperature by 23.0 Kelvin when exactly 1284 Joules of energy get absorbed. Calculate the C of Bi.

9 ANSWER

At what temperature (°C) would you use the $q = mH_F$ formula for aluminum?

This would be at the freezing/melting point.
Table S shows 933 K.

$$K = C + 273$$

$$933\ K = C + 273K$$

$$660°C = C$$ *(unlimited SF)*

10 ANSWER

454 g of Bi (☺) will change temperature by 23.0 K when 1284 J of energy get absorbed. What's the C of Bi?

$$q = mC\Delta T$$

$$1284\ J = (454\ g)(C)(23.0\ K)$$

$$\frac{1284\ J}{(454\ g)(23.0\ K)} = C$$

$$0.123\ J/g{\cdot}K = C$$ (3 SF)

11

The C of Cu is 0.391 J/g·K

A hunk of copper absorbs 3752 Joules. Its temperature warms from 280.0K → 381.0K. What is the mass of this piece of metal?

12

H_2O starts out at 274 K and gets vaporized. What formula, or formulas, would you use to calculate the total energy required?

- $q = mH_F$ *only*
- $q = mC\Delta T$ *only*
- $q = mC\Delta T$ *and* $q = mH_F$
- $q = mC\Delta T$ *and* $q = mH_V$
- $q = mH_F$ *and* $q = mC\Delta T$

11 ANSWER

The C of Cu is 0.391 J/g·K

A hunk of copper absorbs 3752 Joules. Its temperature warms from 280.0K → 381.0K.

What is the mass of this piece of metal?

$$q = mC\Delta T$$

$$3752\ J = (m)(0.39 J/g\cdot K)(101.0\ K)$$

$$\frac{3752\ J}{(0.391 J/g\cdot K)(101.0\ K)} = m$$

95.01 g copper = m (4 SF)

12 ANSWER

Some H_2O starts out at 274 K and gets vaporized. What formula, or formulas, would you require to calculate the total energy requirement to do this?

Liquid water needs to be warmed up to the boiling point, then the water gets vaporized, so it's

$$q = mC\Delta T \textit{ and } q = mH_V$$