

Given: specific heat of water = 1.00 cal/g·°C

Heat of fusion of H₂O = 80. cal/g Heat of vaporization of H₂O = 540 cal/g

Caloric values: carbohydrate, 4 kcal/g fat, 9 kcal/g protein, 4 kcal/g

PART 1. MULTIPLE CHOICE and FILL IN THE BLANK. Circle the best answer or fill in the blank. **CAUTION:** Some questions may appear similar to homework questions but are probably not exactly the same.

1. The state of matter that has a definite volume and definite shape is the _____ **solid** _____. (2 pts.)
2. Vaporization is the change of state from _____ **liquid** _____ to _____ **gas** _____. (2 pts.)
3. In the Scientific Method, what is a “theory” and what is a “hypothesis”? (4 pts.)
4. The changing of a gas into a solid is called _____ **deposition** _____. (2 pts.)
5. _____ **specific heat** _____ is the amount of heat needed to raise the temperature of 1 g of a substance by 1°C. (2 pts.)
6. What is the definition of the Heat of Fusion? (2 pts.)
The amount of heat needed to convert a solid into a liquid.

16. What is the best answer to the following expression? $(11.\underline{2} + 3.0\underline{4} + 12\underline{1}) = 135.24 = 135$
(2 pts.) (Follow significant figure rules.)

The last significant place of 11.2 is the tenth's place, of 3.04 is the hundredth's place, and of 121 is the one's place. The one's place is furthest to the left, so the answer only goes to the one's place.

17. What is the best answer to the following expression? $(15\underline{1} - 1\underline{2}0) = 31 = 30$
(2 pts.)

18. What is the best answer to the following expression? $\frac{(0.21)(70)}{(0.0035)} = 4200 = 4000$
(2 pts.)

The number 70 has the fewest significant figures (1 sig. fig.) so the answer can only have 1 sig. fig.

19. What is the best answer to the following expression? $\frac{(12.11 - 12.01)}{583}$ (2 pts.)

$12.11 - 12.01 = 0.10$, then $0.10/583 = 0.000171526 = 0.00017$ or 1.7×10^{-4}

20. Fill in the chemical name of the given chemical symbol. (1 pt. each)

- | | |
|------------------------------------|-----------------------------------|
| a) Mn _____ <u>manganese</u> _____ | b) Na _____ <u>sodium</u> _____ |
| c) Ag _____ <u>silver</u> _____ | d) Cl _____ <u>chlorine</u> _____ |
| e) Pt _____ <u>platinum</u> _____ | f) Ti _____ <u>titanium</u> _____ |
| g) S _____ <u>sulfur</u> _____ | h) B _____ <u>boron</u> _____ |

21. Fill in the chemical symbol of the given chemical name. (1 pt. each)

- | | |
|-----------------------------------|----------------------------------|
| a) gold _____ <u>Au</u> _____ | b) helium _____ <u>He</u> _____ |
| c) potassium _____ <u>K</u> _____ | d) arsenic _____ <u>As</u> _____ |
| e) barium _____ <u>Ba</u> _____ | f) fluorine _____ <u>F</u> _____ |
| g) iron _____ <u>Fe</u> _____ | h) copper _____ <u>Cu</u> _____ |

PART 2. PROBLEMS. Show all units. Show all answers to correct significant figures. SHOW WORK for Partial Credit.

22.) $82 \text{ K} = \underline{-191} \text{ } ^\circ\text{C}.$ (3 pts.)

$$82 \text{ K} - 273.15 = -191^\circ\text{C}$$

23.) $103^\circ\text{F} = \underline{39} \text{ } ^\circ\text{C}.$ (4 pts.)

$$T_{\text{C}} = \frac{(T_{\text{F}} - 32)}{1.8} = 39^\circ\text{C}$$

24.) $820 \text{ mg} = \underline{0.82} \text{ g}$ (3 pts.)

$$820 \text{ mg} \left(\frac{1 \text{ g}}{1000 \text{ mg}} \right) = 0.82 \text{ g}$$

25.) $84 \text{ cm} = \underline{2.8} \text{ ft}.$ (4 pts.)

$$84 \text{ cm} \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \right) \left(\frac{1 \text{ ft.}}{12 \text{ in.}} \right) = 2.8 \text{ ft.}$$

26.) $7400 \text{ } \mu\text{L} = \underline{7.4} \text{ mL}$ (4 pts.)

$$7400 \mu\text{L} \left(\frac{1 \times 10^{-6} \text{ L}}{1 \mu\text{L}} \right) \left(\frac{1000 \text{ mL}}{1 \text{ L}} \right) = 7.4 \text{ mL}$$

- 27.) A sample is weighed in lab giving 42.223 g, and the volume was measured to be 3.18 mL. What is the density of this sample? (4 pts.)

$$\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{42.223 \text{ g}}{3.18 \text{ mL}} = 13.3 \text{ g/mL}$$

- 28.) Gold has a density of 19.3 g/mL. What is the mass of a 10.0 mL sample of gold? (5 pts)

$$d = \frac{m}{v} \quad , \quad m = v * d = \left(\frac{19.3 \text{ g}}{\text{mL}} \right) (10.0 \text{ mL}) = 193 \text{ g}$$

- 29.) A fish tank holds 71.8 L of water. What is this volume in cubic feet? (5 pts.)

$$71.8 \text{ L} \left(\frac{1000 \text{ mL}}{1 \text{ L}} \right) \left(\frac{1 \text{ cm}^3}{1 \text{ mL}} \right) \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \right) \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \right) \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \right) \left(\frac{1 \text{ ft.}}{12 \text{ in.}} \right) \left(\frac{1 \text{ ft.}}{12 \text{ in.}} \right) \left(\frac{1 \text{ ft.}}{12 \text{ in.}} \right) = 2.54 \text{ ft}^3$$

- 30.) How many kilocalories of heat must be added to change 73.0 g of water at 100°C to gas at 100°C? (4 pts.)

$$73.0 \text{ g} \left(\frac{540 \text{ cal}}{1 \text{ g}} \right) \left(\frac{1 \text{ kcal}}{1000 \text{ cal}} \right) = 39 \text{ kcal}$$

- 31.) How many kilocalories of heat must be added to heat a 82.0 g sample of water from 22.0°C to 100.0°C? (4 points)

$$\text{heat} = (\text{specific heat})(\text{mass})\Delta T = \left(\frac{1.00 \text{ cal}}{\text{g} \cdot ^\circ \text{C}} \right) (82.0 \text{ g}) (100.0^\circ \text{C} - 22.0^\circ \text{C}) \left(\frac{1 \text{ kcal}}{1000 \text{ cal}} \right) = 6.40 \text{ kcal}$$

- 32.) A popular meal replacement bar contains 2.5 g of fat, 4.0 g of protein, and 22 g of carbohydrate. How many kilocalories does this serving have? How many Food Calories is this? Please report answers to 3 sig. figs. (4 pts.)

$$2.5 \text{ g fat} \left(\frac{9 \text{ kcal}}{1 \text{ g}} \right) = 22.5 \text{ kcal}$$

$$4.0 \text{ g protein} \left(\frac{4 \text{ kcal}}{\text{g}} \right) = 16 \text{ kcal}$$

$$22 \text{ g carbs} \left(\frac{4 \text{ kcal}}{\text{g}} \right) = 88 \text{ kcal}$$

$$22.5 \text{ kcal} + 16 \text{ kcal} + 88 \text{ kcal} = 127 \text{ kcal} = 127 \text{ Food Cal}$$