

Multiple Choice: (4 points each. Put answers in left margin as capital letters.)

- Which of the following elements is an alkaline earth element?
A) argon B) chlorine **C) magnesium** D) sodium E) sulfur
- A block has a temperature of 150 °C. What is its temperature in K?
A) 66 B) 122 C) 227 D) 302 **E) 423**
- How many significant figures are in the answer to the following problem? $(305 + 747) \times 12$?
A) 1 **B) 2** C) 3 D) 4 E) 5
- Which of the changes is a chemical change?
A) A stove burner is heated until it glows orange.
B) A warm soda bottle fizzes when opened.
C) A cord is plugged into a wall socket and electricity flows to turn on a light bulb.
D) Natural gas is heated until a flame is produced.
E) None are chemical changes

Substance	Specific heat [J/(g · °C)]
lead	0.128
silver	0.235
copper	0.385
iron	0.449
aluminum	0.903
water	4.184

- An unknown substance has a mass of 13.4 g. The temperature of the substance increases by 14.1 °C when 72.7 J of heat is added to the substance.
A) aluminum **B) copper** C) iron D) lead E) silver
- Which of the following chemical equations best describes the statement, “magnesium metal is heated in the presence of gaseous oxygen to produce solid magnesium oxide”?
A) $2 \text{Mg}_{(s)} + \text{O}_{2(g)} \rightarrow 2 \text{MgO}_{(s)} + \text{heat}$ **C) $2 \text{Mg}_{(s)} + \text{O}_{2(g)} + \text{heat} \rightarrow 2 \text{MgO}_{(s)}$**
B) $2 \text{MgO}_{(s)} + \text{heat} \rightarrow 2 \text{Mg}_{(s)} + \text{O}_{2(g)}$ D) $2 \text{MgO}_{(s)} + \text{O}_{2(g)} \rightarrow 2 \text{Mg}_{(s)} + \text{heat}$
- A typical atom is about a factor of _____ times the size of its nucleus?
A) 1 B) 10 C) 100 D) 1,000 **E) 10,000**
- The correct number of protons, neutrons, and electrons in S^{2-} (sulfur-32) is:
A) 14p, 16n, 16e C) 16p, 16n, 16e **E) 16p, 16n, 18e**
B) 14p, 14n, 16e D) 16p, 18n, 16e

9. On another planet, the isotopes of titanium have the given natural abundances.

Isotope Abundance Mass (amu)

^{46}Ti 70.200% 45.95263

^{48}Ti 12.200% 47.94795

^{50}Ti 17.600% 49.94479

What is the average atomic mass of titanium on that planet?

- A) 45.882 amu **C) 46.899 amu** E) 48.998 amu
B) 46.759 amu D) 47.948 amu

10. Which element is most likely to form a cation?

A) As **B) Bi** C) N D) P E) Sb

11. What is the charge on sulfur in SO_3^{2-} ?

A) 0 B) +2 C) +3 **D) +4** E) +6

12. Identify the chlorate ion:

A) Cl^- B) ClO^- C) ClO_2^- **D) ClO_3^-** E) ClO_4^-

Discussion Questions:

1. Define: (4 points each)

energy – the ability to do work or transfer heat

nucleus – the positively charged, high mass particle at the center of an atom

binary compound – a molecule or salt made of two different elements

Fill-in-the-blanks (4 points each)

- What are the units that make up a Joule? $\text{kg}\cdot\text{m}^2/\text{s}^2$
- Provide an English/metric conversion factor for **mass**: 454 g/pound
- BI_3 boron triiodide, P_2S_3 diphosphorus trisulfide
- K_2SO_4 potassium sulfate, TiO_2 titanium(IV) oxide
- hydrobromic acid $\text{HBr}_{(\text{aq})}$, phosphoric acid H_3PO_4
- How are the amu (Dalton, atomic mass unit) and gram related to each other?
There are an Avogadro's number (6.022×10^{23}) of amus in one gram.

7. What is the formula for the force of attraction between two ions of opposite charge?
 $K (\text{cation charge})(\text{anion charge})/(\text{separation distance})$
8. Complete the following sentence, the first law of thermodynamics: Energy may be interconverted but it cannot be created or destroyed.

Show your work problems (4 points each)

1. How many liters are in 1.0 gallon?

$$\text{Volume (L)} = (1.0 \text{ gal}) \left(\frac{4 \text{ qt}}{1 \text{ gal}} \right) \left(\frac{1 \text{ L}}{1.05 \text{ qt}} \right) = 3.8 \text{ L}$$

2. Calculate the specific heat of a solid in J/g•°C if 1638 J raises the temperature of 155 g of it from 25.0 °C to 42.6 °C.

$$\text{spec, heat} = \frac{1638 \text{ J}}{(155 \text{ g})(42.6 \text{ °C} - 25 \text{ °C})} = 0.600 \text{ J/g} \cdot \text{°C}$$