

Use the Scantron for Questions 1-26 (2 points each). Mark only one answer unless instructed otherwise.

Chp 4 Basic questions

Energy-calorie joule calculations:

If a candy bar has 125,000 calories: (Show all your work for full credit.)

A) (2 pt) How many joules are in this candy bar? (1 J = 0.239 cal)

$$125,000 \text{ cal} \times \frac{1 \text{ J}}{0.239 \text{ cal}} = 523,000 \text{ J}$$

B) (4 pt) Calculate the number of food calories (Cal) in this candy bar. (Hint: 1 Cal = 1 kcal)

$$125,000 \text{ cal} \times \frac{1 \text{ kcal}}{1000 \text{ cal}} \times \frac{1 \text{ Cal}}{1 \text{ kcal}} = \boxed{125 \text{ Cal}}$$

Use the following answers for Questions 1-3

A) Kinetic Energy B) Energy C) Potential Energy D) Conservation of Energy E) No answer

1. The simplest definition of B is the capacity to do work.
2. The capacity to do work from the motion of an object is called A.
3. C is the energy an object possesses by virtue of its position or state.

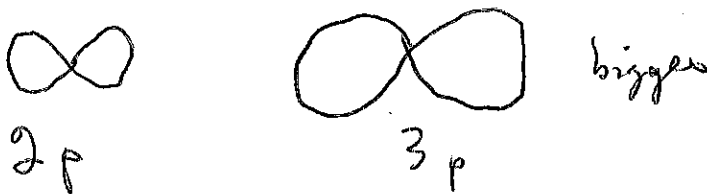
The Mysterious Electron:

4. Atomic emission spectra in the visible region produces discrete colored line spectra for every element. Which of the following are true regarding these line spectra
 - a) The line spectra occur when electrons in the atoms undergo quantum jumps from higher energy to lower energy orbitals and emit light in the process.
 - b) Atomic emission spectra are used to identify elements.
 - c) All elements give the same atomic emission line spectra.
 - d) a and b
 - e) none are true
5. Which of the following is a TRUE statement concerning the quantum model of the atom.
 - a) atomic orbitals exist in discrete energy levels
 - b) the subenergy levels are designated as s, p, d, f
 - c) the ground state exists when the electrons occupy the lowest energy orbitals.
 - d) electrons in atoms exist at specific (discrete) energies.
 - e) ALL of the above are TRUE statements
6. The maximum number of electrons that can occupy one p sublevel orbital
 - a) 2
 - b) 4
 - c) 6
 - d) 8
 - e) 10

18 pt

7. What is the maximum number of electrons that can occupy the 3rd principal energy level? *s p d = 18*
 (a) 2 (b) 8 (c) 18 (d) 32 (e) 50
8. What are all the sublevels that exist in principal energy level 2?
 a) s (b) s, p (c) s, p, d (d) s, p, d, f (e) s, p, d, f, g
9. Which of the following sublevel (subshell) is filled first?
 (A) 3s (B) 3p (C) 3d (D) 4s (E) 4p
10. Which element has 4 valence electrons in the 5th energy level?
 A) Zr (B) V (C) Sn (D) Mo (E) Sb

(4 pt) Draw a picture that depicts the shapes and relative sizes of a 2p and a 3p orbital. Be sure to label your pictures either 2p or 3p.



(12 pts) Write the electron configuration and the orbital energy diagram for phosphorus. For example, Li is

$15P$ $1s^2 2s^2 2p^6 3s^2 3p^3$

Orbital energy diagram for Phosphorus:

$3p^3$	\uparrow	\uparrow	\uparrow
$3s^2$	$\uparrow\downarrow$		
$2p^6$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow$
$2s^2$	$\uparrow\downarrow$		
$1s^2$	$\uparrow\downarrow$		

Example for Li: $2s^1 \uparrow$ and $1s^2 \uparrow\downarrow$

11. The electrons that occupy the highest energy orbitals in a ground state atom are called:

- a) a complete octet
- (b) valence electrons
- c) the d orbital electrons
- d) the s electrons
- e) None of the above are correct

12. In the periodic table the number assigned to each period corresponds to the

- a) number of valence electrons
- (b) the highest occupied principle energy level (shell)
- c) the total number of electrons in the s and p orbitals
- d) the atomic weights of the elements
- e) properties of the elements

Chp 5 Basic questionsCharacteristics of matter-mixtures-pure-elements-compounds:

14. Which of the following is a pure substance that can be broken down by various chemical means into two or more simpler substances?

- a) mixture b) compound c) element d) atom e) solution

15. Chemistry is the study of _____

- A) matter and how it changes.
B) energy and its various forms.
C) space and planets.
D) plants and their structure.
E) animals and their behavior

16. Which of the following is not a compound?

- A) CO₂ B) Nitrogen dioxide C) Br₂ D) Sodium oxide E) CCl₄

17. Which of the following describes these substances: beach sand, oatmeal and ground pepper.

- a) Element b) pure substance c) homogeneous mixture d) heterogeneous mixture

Chemical bonding:

18. Which of the following categories contains the most elements?

- a) metals b) nonmetals c) metalloids d) noble gases e) representative elements

19. Which of the following is NOT a metal?

- a) Al b) Bi c) Br d) Mn e) Pb

20. Which of the following is a covalent compound?

- A) Cu²⁺ B) P₂O₅ C) SnF₂ D) SO₃²⁻

21. Which of the following **is not** isoelectronic with Ar?

- A) Cu⁺ B) S²⁻ C) Ca²⁺ D) Sc³⁺ E) all are isoelectronic with Ar

22. Which of the following is a statement of the rule of eight (octet rule)?

- a) bond with eight other electrons.
b) a stable configuration of eight valence electrons.
c) form eight variations of molecules.
d) follow the Eight Rules of Bonding.
e) four bonding pair of electrons.

Lewis structures and shapes:

23. A Lewis formula or Lewis diagram is used to show what?

- A. The physical properties of the compound
B. How Lewisite can be made in the laboratory
C. Whether a bond is polar or nonpolar
D. How metals form alloys
E. The arrangement of atoms and electrons in a molecule

24. Which of the following is another term for *unshared electron pairs*?

- A. Covalent pairs B. Ionic pairs C. Valence pairs D. Lone pairs E. Bonding electron pairs

Draw the Lewis structure for NO_2^- and fill in the blanks in the table (14 pt total)

<p>Lewis structure (6 pt)</p>	Valence Electrons (2 pt)	$5 + 2(6) + 1 = 18$
	Electron group geometry (2 pt)	trig. planar
	Bond Angle (2 pt)	120°
	Molecular geometry (2 pt)	bent

Chp 4 Challenge Questions

(7 pt) The heat capacity of water is $\frac{1 \text{ cal}}{1^\circ\text{C} \cdot 1 \text{ g}}$. Calculate how many calories are needed to raise the

temperature of 500.0 g of water (about one pint) from 23°C to 80°C

(Hint: In solving this problem the temperature to use is the temperature difference between the initial and final temperatures. Use the heat capacity and do calculations to cancel the units until only cal is left.)

$$\begin{aligned}
 ? \text{ cal} &= 500.0 \text{ g} / \cancel{\text{g}} \times (80 - 23)^\circ\text{C} \times \frac{1 \text{ cal}}{1^\circ\text{C} \cdot \cancel{\text{g}}} \\
 &= 500.0 \times 57 \text{ cal} = \boxed{28,500 \text{ cal}}
 \end{aligned}$$

Chp 5 Challenge Questions

25. Which of the following is common between metal and non-metal elements? Both

- a) form cations
- b) form anions
- c) are found in p block elements
- d) conduct electricity
- e) are gases at room temp.

26. A large box contains a white powder of uniform appearance. One sample is taken from the top and another from the bottom. Analysis reveals that the percentage of oxygen in the sample from the top is 58.2%, whereas in the sample from the bottom it is 45.3%. The powder is....

- A) a compound B) an element C) homogeneous D) heterogeneous E) pure

Chp 6 Basic questions

(24 pt) Write the name or symbol for each of the following:

CuSO_4	copper (II) sulfate
Hydrocyanic acid	HCN
diphosphorous pentoxide	P_2O_5
KMnO_4	potassium permanganate
Sulfuric acid	H_2SO_4
NO_3	nitrogen trioxide
Lithium dichromate	$\text{Li}_2\text{Cr}_2\text{O}_7$
$\text{HC}_2\text{H}_3\text{O}_2$	acetic acid
$\text{H}_2\text{S (g)}$	hydrogen sulfide
$\text{Ca}(\text{HCO}_3)_2$	calcium hydrogen carbonate
Ammonium phosphate	$(\text{NH}_4)_3\text{PO}_4$
Mercury (II) hydride	Hg H_2