

Answer each multiple choice by marking only one answer on your scantron unless the question states that there is more than one correct answer. Each multiple choice question is worth 2 pt.

CHP 4 (37 pt)

(6 pt) Calculate the number of food calories (Cal) in a cup of rice that has 2850 kJ of energy (4.184 J = 1 cal).

$$? \text{ Cal} = 2850 \text{ kJ} \times \frac{1000 \text{ J}}{1 \text{ kJ}} \times \frac{1 \text{ cal}}{4.184 \text{ J}} \times \frac{1 \text{ Cal}}{1000 \text{ cal}} = \frac{2850}{4.184} \text{ Cal}$$

= 681 Cal

The Law of Conservation of Energy states that energy can be neither

B
E

1. E, created nor
2. B, destroyed, but it can be
3. C, transferred from one system to another and
4. A, changes from one form to another.

Answers for Questions 1-4
A) Changed
B) Destroyed
C) Transferred
D) Collected
E) Created

5. Which of the following statements about the colors emitted by elements put into a flame is/are correct?






- i. The different colors are evidence that the protons in the atoms are changing energy states.
- ii. The different colors are evidence that electron energies ARE NOT restricted to certain values.
- iii. Light energy is emitted from atoms as electrons move from higher energy levels to lower energy levels.
- iv. Neutral atoms in the ground state emit light spontaneously.

- A) i and ii B) i and iii C) ii & iii D) iii only E) iv only

6. Which of the following shell/subshell designations is not allowed?

- A) 4s B) 1s C) 1p D) 2s E) 2p

7. For the following orbitals, 1s, 2s, 2p, 3s and 3p, which of the following is most likely the 3s?

- A)  1s B)  2s C)  3s D)  2p E)  3p possible

8. Which of the following has the highest energy (use your Aufbau diagram)?

- A) 3s B) 3p C) 3d D) 4s

9. Indicate which of these electron configurations represent elements with similar chemical properties (Mark two answers on your scantron).

- A) $1s^2 2s^1$ B) $1s^2 2s^2$ C) $1s^2 2s^2 2p^1$ D) $1s^2 2s^2 2p^6 3s^1$ E) $1s^2 2s^2 2p^2$
Li Be B Na = both group 1A

10. Which group is the $ns^2 np^2$ group?

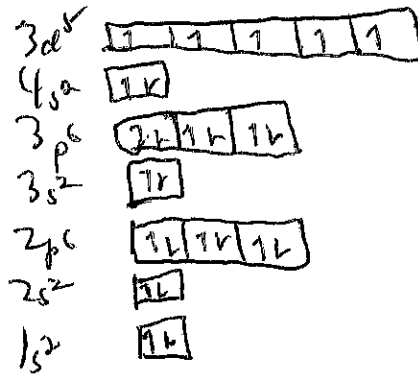
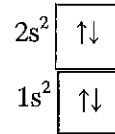
- A) 2A B) 3A C) 4A D) 5A E) 6A

11. Which of the following IS NOT correct?

- A) All the subshells (all the s, p, d's, etc) in a shell (principal energy level) have the same energy. NOT CORRECT
- B) A d subshell always contains five orbitals.
- C) An s orbital has a spherical shape.
- D) All orbitals can hold a maximum of 2 electrons.

(9 pt) Write the electron configuration for manganese Mn $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

Draw the energy orbital diagram for manganese. For example Be is



CHP 5 (46 pt)

12. On the basis of formula which of these is an element? A) H₂ B) CO C) H₂O D) NH₃

13. Which of these elements has the the most valence electrons:
 A) H⁺ B) C[•] C) Na[•] D) Al[•] E) Ne^{••}

14. Which of the following elements will form an anion?
 A) H B) K C) Na D) He E) Ar

15. Which of the following is isoelectronic (same electron configuration) with Ar? $18 e^-$
 (Mark your scantron for all that apply)

- A) Na⁺ [Ne] B) Cl⁻ [Ar] C) O²⁻ [Ne] D) Br⁻ [Kr] E) P³⁻ [Ar]

16. How many bonding pairs/loner pairs are their in the following Lewis structure?

- (A) 2/2 ^{4 / 4} B) 2/4 C) 4/4 D) 4/8 E) 8/8 $\text{:}\ddot{\text{N}}\text{=O}=\ddot{\text{N}}\text{:}$

17. Which of the following bonds has the dipole shown correctly?

- A) $\text{N} \overset{+}{\rightleftarrows} \text{C} \overset{-}{\leftleftarrows}$ B) $\text{O} \overset{+}{\rightleftarrows} \text{H} \overset{-}{\leftleftarrows}$ C) $\text{H} \overset{+}{\rightleftarrows} \text{Br} \overset{-}{\leftleftarrows}$ D) $\text{Cl} \overset{+}{\rightleftarrows} \text{Cl} \overset{-}{\leftleftarrows}$

18. The H-O bond is considered a
 A) non-polar covalent bond B) polar covalent bond C) ionic bond

19. What is the normally expected bonding pattern for the element shown?

- A) $\overset{\cdot\cdot}{\text{O}}$ B) $\overset{\cdot\cdot}{\text{N}}$ C) $\overset{\cdot\cdot}{\text{C}}$ D) $\overset{\cdot\cdot}{\text{Cl}}$

20. Which of the following statements is correct?

- A) Metal elements have greater electronegativity than non-metal elements.
 B) Electronegativity decreases from top to bottom in a group in the periodic table.
 C) Electronegativity increases from top to bottom in a group in the periodic table.
 D) Electronegativity decreases from right to left across a period in the periodic table.

to right

21. All of these molecules have tetrahedral molecular geometry. Which one is a polar molecule?

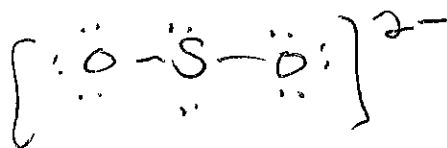
- ma polar bond A) CH₃I
 no polar bonds B) CH₄
 polar C) CH₃Cl
 no lone pair D) CCl₄

E) more than one is polar

put
more
than
one
bond
dipole

(10 pt) Draw the Lewis structure for SO₂²⁻

val electrons = 6 + 2(6) + 2 = 20



(16 pt) For each of the following molecules write the names of the shapes (geometries) and bond angles around the central atom.

STRUCTURE	ELECTRON GROUP GEOMETRY (name)	BOND ANGLE	MOLECULAR GEOMETRY (name)	POLAR (P) or NON-POLAR (NP)
$\text{:N}\equiv\text{N}-\ddot{\text{O}}\text{:}$	linear	180°	linear	P
$\begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \text{F} - \text{N} - \text{F} \\ \cdot\cdot \\ \cdot\cdot \\ \\ \cdot\cdot \\ \cdot\cdot \\ \text{F} \end{array}$	tetrahedral	109.5°	trig. pyramid	P

CHP 6 (34 pt)

(10 pt) Draw a diagram using Lewis dot symbols showing the formation of the cation and anion and write the formula of the resulting ionic compound from the elements Ba and Cl.

LEWIS SYMBOLS

ION SYMBOLS

Ba^{+2} $[\text{:}\ddot{\text{Cl}}\text{:}]^-$

$[\text{:}\ddot{\text{Cl}}\text{:}]^-$

IONIC COMPOUND FORMULA

BaCl_2

22. Which of the following formulas represents a covalent compound? *mark more than one answer.*

- A) NO
 B) No
 C) NH₄⁺
 D) ClO₂
 E) Mg(OH)₂

23. Which of the following are ionic compounds? (Mark your scantron for all that apply)

- A) H₂O
 B) Li₂O
 C) F₂O
 D) NH₃
 E) MgS

24. B = false

25. A = HCl is the only strong acid

(10 pt) Complete the table with names

SO_3 (a common air pollutant from oil refineries)	sulfur trioxide
NH_3	ammonia
KCl (in salt substitute)	potassium chloride
SnF_2 (the fluoride in toothpaste)	tin (II) fluoride
Mg(OH)_2 (in milk of magnesia)	magnesium hydroxide
NaHCO_3 (in baking soda)	sodium hydrogen carbonate
$\text{Zn(ClO}_3)_2$	zinc chlorate
BaSO_4 (used medically for GI X-rays)	barium sulfate
HNO_3	nitric acid
HCl (swimming pool acid)	hydrochloric acid

(10 pt) Complete the following table with formulas

phosphorus trichloride	PCl_3
nitrogen monoxide	NO
silver sulfide (the tarnish on silver)	Ag_2S
iron(II) chloride	FeCl_2
potassium permanganate	KMnO_4
sodium hypochlorite (in bleach)	NaClO
calcium carbonate (marble and chalk)	CaCO_3
ammonium acetate	$\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$
phosphoric acid (in navel jelly and Coke)	H_3PO_4
acetic acid (in vinegar)	$\text{HC}_2\text{H}_3\text{O}_2$

PERIODIC CHART OF THE ELEMENTS

	1A																7A	8A																	
1	H 1.00797	2A															H 1.00797	He 4.0026																	
3	Li 6.939	4	Be 9.0122														5	6	7	8	9	10													
																	B 10.811	C 12.0112	N 14.0067	O 15.9994	F 18.9984	Ne 20.183													
11	Na 22.9898	12	Mg 24.312														13	14	15	16	17	18													
																	Al 26.9815	Si 28.086	P 30.9738	S 32.064	Cl 35.453	Ar 39.948													
19	K 39.102	20	Ca 40.08	21	Sc 44.956	22	Ti 47.90	23	V 50.942	24	Cr 51.996	25	Mn 54.938	26	Fe 55.847	27	Co 58.9332	28	Ni 58.71	29	Cu 63.54	30	Zn 65.37	31	Ga 69.72	32	Ge 72.59	33	As 74.9216	34	Se 78.96	35	Br 79.909	36	Kr 83.80
37	Rb 85.47	38	Sr 87.62	39	Y 88.905	40	Zr 91.22	41	Nb 92.906	42	Mo 95.94	43	Tc (99)	44	Ru 101.07	45	Rh 102.905	46	Pd 106.4	47	Ag 107.870	48	Cd 112.40	49	In 114.82	50	Sn 118.69	51	Sb 121.75	52	Te 127.60	53	I 126.904	54	Xe 131.30
55	Cs 132.905	56	Ba 137.34	*57	La 138.91	72	Hf 178.49	73	Ta 180.948	74	W 183.85	75	Re 186.2	76	Os 190.2	77	Ir 192.2	78	Pt 195.09	79	Au 196.967	80	Hg 200.59	81	Tl 204.37	82	Pb 207.19	83	Bi 208.980	84	Po (210)	85	At (210)	86	Rn (222)
87	Fr (223)	88	Ra (226)	†89	Ac (227)	104	Rf (261)	105	Db (262)	106	Sg (265)	107	Bh (262)	108	Hs (265)	109	Mt (266)	110	? (271)	111	? (272)	112	? (277)												

* Lanthanide Series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
140.12	140.907	144.24	(147)	150.35	151.96	157.25	158.924	162.50	164.930	167.26	168.934	173.04	174.97

† Actinide Series

90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
232.038	(231)	238.03	(237)	(242)	(243)	(247)	(247)	(249)	(254)	(253)	(256)	(258)	(257)

Electronegativity Chart of the Elements

	H 2.1																H 2.1	He --				
	Li 1.0	Be 1.5															B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne --
	Na 0.9	Mg 1.2															Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	Ar --
	K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.8	Ni 1.8	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	Kr --				
	Rb 0.8	Sr 1.0	Y 1.3	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	Xe --				
	Cs 0.7	Ba 0.9	La* 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 1.8	Pb 1.8	Bi 1.9	Po 2.0	At 2.2	Rn --				
	Fr 0.7	Ra 0.9	Ac† 1.1	Rf	Db	Sg	Bh	Hs	Mt	‡	‡	‡	* Lanthanide Series † Actinide Series									

‡ IUPAC has not yet named these elements.