

DO NOT OPEN THE EXAM UNTIL YOU ARE TOLD TO DO SO.

In the meantime, read this...

You will write all of your answers on the answer sheets, on the next two pages. At the end of the exam, turn in **your entire test booklet, with Answer Sheet, and your Scantron card.**

 **Write your name:**

-  on every PAGE of the exam (both sides of every sheet), and
-  on the Scantron card.

You may use your calculator and a pen or pencil. Please do not use green or red. Please use a pencil on the Scantron card; ink does not score reliably.

Problems marked ** come straight from the assigned homework or from worksheets in class.

Put all notes, books, etc away and out of sight. Turn off the ringers of electronic devices and put them away and out of sight. **Electronic devices (other than calculators) must be silenced and put away. Use of calculator functions on communication devices is not permitted. Sharing calculators is not permitted.** Points will be deducted for electronic devices in view or making noise, and devices will be confiscated.

No outside paper is allowed. If you need more scratch paper, ask one of the proctors.

Strategy hint: take a quick look over the whole exam before you start. If you see something that looks easy for you, go for it! It's good to get a few points in the bag right away.

Strategy hints for multiple choice:

- when you have determined that an option is not correct, mark it off so you don't have to check it again!
- even if you think you have found the right answer, look at the remaining answers to see if any of them are a better match.
- on calculation problems, show your work somewhere on the page. Even if you miss the problem, it certainly will be easier to see later where mistakes were made.

Looking at another student's work, intentionally or accidentally, will not be tolerated. Students who seem to have trouble keeping their eyes on their own papers will be moved to the front of the room. Students who cheat earn a failing grade.

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Periodic Table of the Elements

1A		2A																		3A	4A	5A	6A	7A	8A	
1 H 1.008																						1 H 1.008	2 He 4.003			
3 Li 6.941	4 Be 9.012	3B		4B		5B		6B		7B		8B				1B		2B		5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18	
11 Na 22.99	12 Mg 24.31																			13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95	
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.41	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80									
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc [98]	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3									
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po [209]	85 At [210]	86 Rn [222]									
87 Fr [223]	88 Ra [226]	89 Ac [227]	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [277]	109 Mt [268]	110 Ds [281]	111 Rg [272]	112 [285]	113 [284]	114 [289]	115 [288]	116 [292]											
Lanthanides		58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm [145]	62 Sm 150.4	63 Eu 152.0	64 Gd 157.2	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0											
Actinides		90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]	103 Lr [262]											

You may remove this page and use it as scratch paper and a cover sheet. If you need more scratch paper, you may get it from the proctor.

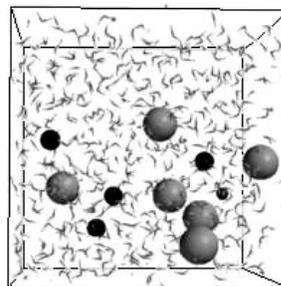
Part B. Multiple Choice [3 points each]. Choose the **best** answer and record it on your Scantron card.

1 Which of the following is a characteristic of a sample of an **element**?

- A Can be broken down into two or more other substances by heating
- B Is made up of other, simpler substances in a fixed ratio
- C Is made up of other, simpler substances in a variable ratio
- D All atoms have the same number of protons
- E Name typically ends in “-ide”

2 The sample pictured is best classified as:

- A an element.
- B a covalent/molecular compound.
- C an ionic compound.
- D a mixture.



3 Which of the following properties is generally true of a **noble gas**?

- A conducts electricity
- B combines with metals to form ionic compounds
- C forms anions in ionic compounds
- D combines with nonmetals to form covalent compounds
- E relatively unreactive and does not form compounds

4 Which of the following is the name of an **ionic compound**?

- A carbon disulfide
- B silicon carbide
- C propane
- D potassium
- E sodium carbonate

5 From the following list, which statement could possibly be **correct** based on the size of the measurement?

- A A computer mouse weighs 160 μg .
- B My coffee cup holds 220 mL of coffee.
- C This exam paper is 9 cm long.
- D A penny has a diameter of 19 dm.

6 How many **protons** are in an atom of sulfur?

- A 11
- B 14
- C 16
- D 23
- E 32

7 What is the most likely **mass number** for a single atom of sulfur?

- A -2
- B 16
- C 17
- D 32
- E 32.07

8 Which of the following statements is the most accurate description of the substance PbO_2 ?

- A PbO_2 is an ionic compound, containing Pb^{2+} and O^- ions.
- B PbO_2 is an ionic compound, containing Pb^{4+} and O^{2-} ions.
- C PbO_2 is an ionic compound, containing Pb^{4+} and O_2^{4-} ions.
- D PbO_2 is a covalent compound, containing Pb atoms and O_2 molecules.
- E PbO_2 is a covalent compound, in which Pb and O are connected through covalent bonds to form molecules.

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Problems 9-17 refer to the following five options. You may use each option once, more than once, or not at all.

A Si

B S

C Sc

D Sr

E Sn

- 9 Which element forms a -2 ion?
- 10 Which of the elements is a transition metal?
- 11 Which element combines in a 1:1 ratio with magnesium to form an ionic compound?
- 12 Which element can form BOTH covalent and ionic compounds?
- 13 Which element is in the same Group with calcium?
- 14 If you have a 1-mole sample of each element, which sample has the greatest mass?
- 15 Which element is an alkaline earth element?
- 16 Which element has 6 valence electrons in its neutral atoms?
- 17 Which element forms a $+2$ ion exclusively?

The descriptions in the next few items refer to the following five options. You may use each option once, more than once, or not at all.

A F_2 B OF_2

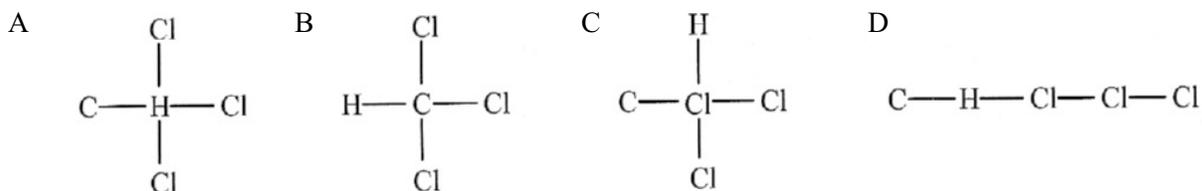
C Fe

D Fr

E FeF_2

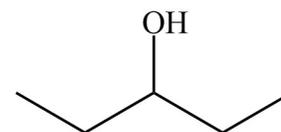
- 18 An ionic compound
- 19 A diatomic molecule
- 20 A substance with a molar mass of 54 g
- 21 A nonmetal element
- 22 A molecular/covalent compound
- 23 How many **bonding electrons** are there in a molecule of hydrocyanic acid (shown)? $H-C\equiv N:$
- A 4 B 5 C 8 D 10 E 14

24 Based on the normal bonding patterns of the atoms involved, which of the structures shown is most likely to exist?



25 How many **carbon atoms** are there in the organic molecule shown at right?

- A 0 (this molecule does not contain carbon) B 5 C 6
D 10 E 22



26 Which of these is a **saturated organic** molecule?

- A cyclobutene B carbon monoxide C propyne
D ethane E 2-pentene

27 Mark **both** the "A" and "D" spaces on your Scantron card. (This item is a form identifier and will not be scored.)

(MC score _____ FR score _____ Total raw _____ total % _____)

Free-Response ANSWER SHEET. Write your answers in the spaces provided.1. Give the correct **chemical formula** for each substance named. [2 each]

_____ sodium nitride

_____ methane

_____ calcium hydroxide

_____ iron(II) phosphate

_____ phosphorus pentachloride

_____ nitrous oxide

4. Give a **correct systematic name** for each formula. [2 each]_____ S_2Cl_6 _____ Cu_2O _____ $Al(NO_3)_3$ _____ NH_3 _____ MgF_2 _____ $H-C\equiv C-H$ 2. Give a **reasonable** estimate, with **appropriate metric** unit, for each of the following. [2 each]

a. the volume of your phone.

b. the thickness of your textbook.

c. the mass of a pair of sunglasses.

5. Give the symbol of an element that fits each description. In some cases, there may be more than one acceptable answer; choose **one**. [2 each]

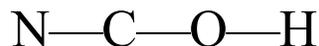
_____ a nonmetal in the same group with aluminum

_____ a main group metal

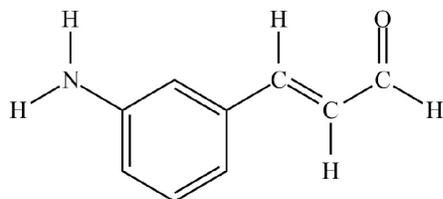
_____ an element whose neutral atoms have 4 valence electrons

_____ an element that can form both covalent and ionic compounds

3. [4 pts] **Complete the structure:** Add lone pair electrons, or turn single bonds into double or triple bonds, to complete the following structure so that every atom has its normal electron arrangement. (**Do not** add any atoms to the molecule.)



6. In the structure below, circle and appropriately label all **functional groups**. [8 pts]



7. [11 pts] In the space below, draw the structure of **5-ethyl-3,4,6-trimethyl-3-octene**.

8. Fill in the blanks in the table below. [1 point each]

formula	atomic number	mass number	# of protons	# of electrons	# of neutrons	charge
O					9	0
	30			28	37	
V ³⁺		50				