

Name _____ Section Number _____

Please read the following before proceeding

1. Materials: Turn off cell phones and wireless PDA devices. You will need a pencil and Scantron answer form. Place all other materials on the floor. You may remove the second page of the exam.
2. This exam is multiple choice. There will be no partial credit. The exam will be Scantron scored. On the Scantron card, please make sure that you **bubble-in your GTid number**. In the space provided, write your **Name**. Write the exam color in the Subject section. Write your **section number** in the Hour/Date section. See sample below.
3. Show your Buzz Card when you turn in your completed exam and Scantron card. You must work alone. Give or take no assistance from other students. Recall the Georgia Tech Honor Code.

“I pledge my honor that I have not violated the Honor Code during this examination.”

Signed _____

The image shows a Scantron ParSCORE™ SCORE SHEET. At the top, it says "ParSCORE™ SCORE SHEET" and "SCANTRON FORM NO. F-16457-PAR-L © SCANTRON CORPORATION 2002". The student's name is written as "LAST NAME, FIRST NAME". The subject is "color of test". The date is "9/17/04" and the hour/day is "TA name or section # (e.g. L2, B3)". The ID number is "901234567". The answer bubbles are filled in with letters A, B, C, D, E. A key at the bottom lists the answers for bubbles A1 through B4.

Use Pencil Only

A1	Hsiao
A2	Arnstein
A3	Phillips
A4	McGrier
B1	Hsiao
B2	Arnstein
B3	Phillips
B4	McGrier

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Pressure

1 Pa = 1 kg m⁻¹ s⁻² = 1 N m⁻²

1 atm = 101,325 Pa = standard pressure

1 bar = 100,000 Pa = 0.986923 atm

1 torr = (101,325 / 760) Pa = (1/760) atm

1 mm Hg at 0°C = (101,325/760) Pa = (1/760) atm

1 psi = 1 lbf in⁻² = 6897.757 Pa = (1/14.69595) atm

STP

Standard pressure = 1 atm

Standard temperature = 0°C = 273.15°K

Universal Gas Constant

R = 8.31447 J mol⁻¹ K⁻¹ = 0.0820574 L atm mol⁻¹ K⁻¹

PERIODIC TABLE OF THE ELEMENTS																	
1 H 1.008																	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.999	10 Ne 20.180
11 Na 22.989	12 Mg 24.305											13 Al 26.982	14 Si 28.0856	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.955	22 Ti 47.867	23 V 50.941	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.467	38 Sr 87.62	39 Y 88.905	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98	44 Ru 101.07	45 Rh 102.905	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 La to 71	72 Hf 178.49	73 Ta 180.947	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac to 103	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 264	108 Hs 265	109 Mt 268	110 Uun 269	111 Uuu 272	112 Uub 277						

57 La 138.906	58 Ce 140.116	59 Pr 140.908	60 Nd 144.24	61 Pm 145	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
89 Ac 227	90 Th 232.038	91 Pa 231.036	92 U 238.029	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

Table 4-1
Solubilities of Ionic Compounds in Water

Anion	Soluble ^a	Slightly Soluble	Insoluble
NO ₃ ⁻ (nitrate)	All	—	—
CH ₃ COO ⁻ (acetate)	Most	—	Be(CH ₃ COO) ₂
ClO ₃ ⁻ (chlorate)	All	—	—
ClO ₄ ⁻ (perchlorate)	Most	KClO ₄	—
F ⁻ (fluoride)	Group I, ^b AgF, BeF ₂	SrF ₂ , BaF ₂ , PbF ₂	MgF ₂ , CaF ₂
Cl ⁻ (chloride)	Most	PbCl ₂	AgCl, Hg ₂ Cl ₂
Br ⁻ (bromide)	Most	PbBr ₂ , HgBr ₂	AgBr, Hg ₂ Br ₂
I ⁻ (iodide)	Most	—	AgI, Hg ₂ I ₂ , PbI ₂ , HgI ₂
SO ₄ ²⁻ (sulfate)	Most	CaSO ₄ , Ag ₂ SO ₄ , Hg ₂ SO ₄	SrSO ₄ , BaSO ₄ , PbSO ₄
S ²⁻ (sulfide)	Groups I and II, ^c (NH ₄) ₂ S	—	Most
CO ₃ ²⁻ (carbonate)	Group I, (NH ₄) ₂ CO ₃	—	Most
SO ₃ ²⁻ (sulfite)	Group I, (NH ₄) ₂ SO ₃	—	Most
PO ₄ ³⁻ (phosphate)	Group I, (NH ₄) ₃ PO ₄	Li ₃ PO ₄	Most
OH ⁻ (hydroxide)	Group I, Ba(OH) ₂	Sr(OH) ₂ , Ca(OH) ₂	Most

^aSoluble compounds are defined as those that dissolve to the extent of 1 g or more per 100 g water, slightly soluble as 0.01 to 1 g per 100 g water, and insoluble as less than 0.01 g per 100 g water at room temperature.

^bCompounds of elements from the first column in the periodic table: Li, Na, K, Rb, Cs.

^cCompounds of elements from the second column in the periodic table: Be, Mg, Ca, Sr, Ba.

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1. On the Scantron card, I have **bubbled-in my GTid number**. I have written my **full name**. I have written the **exam color** in the subject section. I have written my **section number** in the Hour/Date section.

- a. True (correct answer)
- b. False (incorrect answer).

You will not receive credit for this problem if you have not followed all the instructions on the first page.

Answer: a

2. A pure sample of an iron oxide weighing 15 g is heated in a stream of $\text{H}_2(\text{g})$ until it is completely converted to pure iron. If the iron produced has a mass of 10 g, the percentage by mass of oxygen in the original oxide must have been

- a. 14%
- b. 33%
- c. 67%
- d. 86%
- e. none of these

Answer: b

3. Analysis of a sample of magnesium oxide shows that it contains 2.3 g of magnesium and 1.5 g of oxygen. If a second sample of the same oxide contains 6.9 g of magnesium, how much oxygen does it contain?

- a. 0.45 g
- b. 0.51 g
- c. 4.5 g
- d. 5.1 g
- e. none of these

Answer: c

4. An unknown mass of element A reacts completely with 1.8 g of element B and 3.6 g of element C to produce 7.1 g of a compound containing A, B, and C. What additional information is required in order to calculate the unknown mass of A?

- a. a balanced equation for the reaction
- b. the molar masses of A and B
- c. the molar mass of C
- d. all of the above are required
- e. none of the above is required

Answer: e

5. The ratio of the number of oxygen atoms to the number of silicon atoms in $\text{Si}_2\text{O}_2(\text{OH})_2$ is

- a. 1:1
- b. 2:1
- c. 3:1
- d. 1:2
- e. none of these

Answer: b

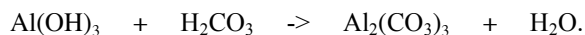
6. A chemist requires 0.01 mol of some liquid for a reaction. If the density of the liquid is 2 g cm^{-3} , and the molecular weight is 100 g mol^{-1} , what volume of the liquid should she use for the reaction?

- a. 0.5 cm^3
- b. 0.05 cm^3
- c. 1.0 cm^3
- d. 10 cm^3
- e. none of these

Answer: a

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7. Consider the unbalanced chemical equation,

When the reaction is balanced with smallest integer stoichiometric coefficients, the coefficient for H_2CO_3 is

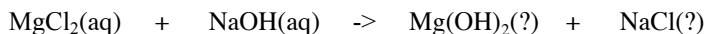
- a. 1
- b. 2
- c. 3
- d. 5
- e. none of these

Answer: c

8. Zinc sulfide (ZnS) reacts with oxygen to form zinc oxide (ZnO) and gaseous sulfur dioxide (SO_2). What mass of SO_2 is produced by the complete conversion of 9.7 g of ZnS to ZnO ?

- a. 3.3 g
- b. 5.0 g
- c. 8.5 g
- d. 10 g
- e. none of these

Answer: e

9. When aqueous solutions of MgCl_2 and NaOH are mixed, a salt precipitates, in accord with the reaction (unbalanced),The (?) indicates unknown phase (s, l, aq or g). How much salt precipitates when 100 mL of a 0.30 M solution of MgCl_2 is mixed with 100 mL of 0.20 M NaOH ?

- a. 0.50 g
- b. 0.58 g
- c. 1.74 g
- d. 1.2 g
- e. none of these

Answer: b

10. In comparison with core electrons the valence electrons of an atom determine most of its chemistry, because the valence electrons are

- a. more negatively charged due to their distance from the center.
- b. more shielded from the effects of approaching atoms.
- c. more strongly affected when other atoms approach.
- d. All of these are correct.
- e. None of these is correct.

Answer: c

11. The positive charge on the nucleus of a neutral atom is equal in magnitude to the

- a. atomic mass.
- b. total charge of the electrons in the atom.
- c. mass number.
- d. all of these.
- e. none of these.

Answer: b

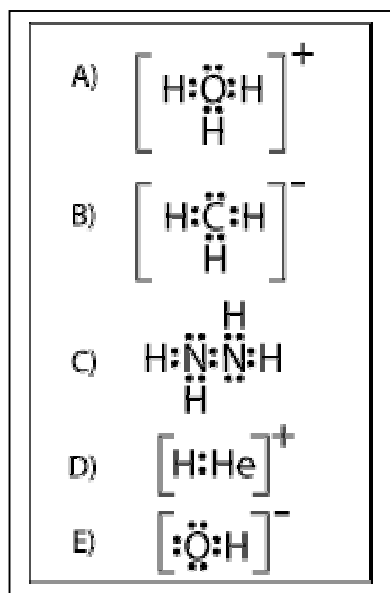
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12. In which of the following atoms is the number of valence electrons equal to three?

- a. Ge
- b. Sn
- c. Pb
- d. all of these
- e. none of these

Answer: e

13. Which of these Lewis dot structures is incorrect?



- a. Structures A and B
- b. Structure C and D
- c. Structure E
- d. all of these
- e. none of these

Answer e

14. The oxidation number of the bromine atom in $\text{Ca}(\text{BrO}_3)_2$ is

- a. -1
- b. +1
- c. +3
- d. +5
- e. none of these

Answer: d

15. If a solution containing 4.0 g of NaOH is exactly neutralized by 100 mL of an aqueous HCl solution, the molarity of the HCl solution must have been

- a. 0.010 M
- b. 0.10 M
- c. 1.0 M
- d. 10 M
- e. none of these

Answer: c

16. Under conditions of fixed temperature and amount of gas, Boyle's law requires that

- a. $P_1V_1 = P_2V_2$
- b. $PV = \text{constant}$
- c. $P_1/P_2 = V_2/V_1$

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- d. all of these
- e. none of these

Answer: d

17. There are how many 3p orbitals in a given atom?

- a. 1
- b. 3
- c. 5
- d. 10
- e. none of these

Answer: b

18. There are how many 4d orbitals in a given atom?

- a. 1
- b. 3
- c. 5
- d. 10
- e. none of these

Answer: c

19. The element with the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ is

- a. Sr
- b. Be
- c. Cl
- d. K
- e. none of these

Answer: e

20. A single 4s orbital can hold how many electrons?

- a. 1
- b. 2
- c. 6
- d. 10
- e. none of these

Answer: b