

Examination 1

Directions:

- Both your **name** and **identification number** must be included and balloons properly darkened. Any errors may result in a point penalty.
- Choose the **best** answer in each of the following. Using a #2 pencil, fill in the corresponding balloon on your scoring sheet.

Potentially Useful Information

$$q = mC \Delta T$$

$$^{\circ}\text{C} = \frac{5}{9} \times (^{\circ}\text{F} - 32^{\circ}\text{F})$$

$$1 \text{ mile} = 5280 \text{ ft}$$

$$^{\circ}\text{C} = \text{K} - 273$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ amu} = 1.6606 \times 10^{-24} \text{ g}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

$$\text{mass of proton} = 1.6726 \times 10^{-24} \text{ g}$$

$$c = 3.000 \times 10^8 \text{ m/sec}$$

$$\text{mass of electron} = 9.1094 \times 10^{-28} \text{ g}$$

$$1 \text{ cal} = 4.184 \text{ J}$$

$$\text{mass of neutron} = 1.6749 \times 10^{-24} \text{ g}$$

The symbol “ ” means “identical to”, that is, with infinite precision (usually because it's a definition).

s-block		d-block transition metals										p-block							
DEPARTMENT OF CHEMISTRY • INDIANA UNIVERSITY -PURDUE UNIVERSITY INDIANAPOLIS																			
1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A		
1 H 1.0079	2 2A											5 B 10.811	6 C 12.0107	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797		
3 Li 6.941	4 Be 9.0122	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 9B	10 10B	11 11B	12 12B	13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948		
11 Na 22.990	12 Mg 24.305	19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.9415	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc [98]	44 Ru 101.07	45 Rh 102.906	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 138.906	72 Hf 178.49	73 Ta 180.948	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 [208.98]	85 At [209.99]	86 Rn [222.0]		
87 Fr [223.0]	88 Ra [226.0]	89 Ac [227.0]	104 Rf [261.1]	105 Db [262.1]	106 Sg [263.1]	107 Bh [264]	108 Hs [265.1]	109 Mt [268]	110 Uun [269]	111 Uuu [272]	112 Uub [277]	Visit our website http://www.chem.iupui.edu							

f-block transition metals														
Lanthanide series	58 Ce 140.116	59 Pr 140.908	60 Nd 144.24	61 Pm [144.9]	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
Actinide series	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np [237.0]	94 Pu [244.1]	95 Am [243.1]	96 Cm [247.1]	97 Bk [247.1]	98 Cf [251.1]	99 Es [252.1]	100 Fm [257.1]	101 Md [258.1]	102 No [259.1]	103 Lr [262]

For admission information
send e-mail to:
chemistry@iupui.edu,
or call:
317.274.6872

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Indiana University -Purdue University
Indianapolis

Each question is worth 4 points. Choose the BEST answer.

1. Gold, silver and lead are represented by the symbols:
 - a. Au, Si, Hg
 - b. Ag, S, Pb
 - c. Au, Sr, La
 - d. Au, Ag, Pb
 - e. ***none of the above***

2. Which symbol represents a nonmetal?
 - a. Ni
 - b. Cl
 - c. Mn
 - d. Si
 - e. Sr

3. The atomic weight listed for an element on the periodic table is
 - a. the weight of the first isotope discovered.
 - b. the weight of the most stable isotope.
 - c. an average of the weights of all naturally-occurring isotopes.
 - d. the weight of the heaviest isotope known.
 - e. the sum of the weights of all stable isotopes.

4. The elements Cr and Mo are examples of
 - a. transition metals.
 - b. alkaline earth metals.
 - c. alkali metals.
 - d. halogens.
 - e. rare earths.

5. Which of the following elements is misspelled?
 - a. silicone
 - b. chlorine
 - c. potassium
 - d. uranium
 - e. ***all are correctly spelled***

6. Which of the following is an alkaline earth metal?
 - a. arsenic
 - b. strontium
 - c. vanadium
 - d. rubidium
 - e. uranium

7. An atom with a mass number of 59 that has 28 protons will have _____ neutrons.
- 14
 - 28
 - 31
 - 59
 - 87
8. What is the approximate mass of 10 chromium atoms?
- 10 amu
 - 24 amu
 - 52 amu
 - 240 amu
 - 520 amu
9. When a substance undergoes a *physical* change
- it always undergoes a change of state.
 - the process cannot be reversed.
 - a new substance is produced.
 - its chemical composition remains unchanged.
 - heat is always given off.
10. What is the approximate mass in grams of 100 atoms of fluorine?
- 19 g
 - 190 g
 - 1.6×10^{-22} g
 - 3.2×10^{-21} g
 - 3.2×10^{-24} g
11. The number 78.6543 should be correctly rounded to what value in order to have exactly 3 significant figures?
- 80.0
 - 78.6
 - 78.7
 - 78.654
 - 7.86×10^{-3}
12. Which of the following would you expect to be chemically similar to chlorine?
- Ar
 - F and Br
 - Se and Ne
 - O and Kr
 - P and S

13. A neutral atom with 16 protons and 14 neutrons has
- atomic number = 16, mass number = 14, symbol: Si
 - atomic number = 14, mass number = 30, symbol: Si
 - atomic number = 16, mass number = 30, symbol: S
 - atomic number = 14, mass number = 30, symbol: S
 - atomic number = 16, mass number = 32.066, symbol: S
14. A single orbital may, at most, contain
- 1 proton.
 - 2 protons.
 - 6 protons.
 - 2 electrons.
 - 6 electrons.
15. The formula for a compound consists of 1 magnesium atom, 1 sulfur atom and 4 oxygen atoms. Which of the following is the correct formula?
- MgSrO
 - MgSO
 - MgSO₄
 - MgS₄O
 - MgSFO₄
16. Which of these orbitals has the highest energy?
- 1s
 - 2s
 - 3s
 - 4s
 - 5s
17. Which characteristics correctly describe a neutron?
- charge of +1; mass approximately 1 amu; located inside the nucleus
 - charge of -1; mass approximately 1 amu; located inside the nucleus
 - charge of 0; mass approximately 1 amu; located inside the nucleus
 - charge of 0; mass approximately 1 amu; located outside the nucleus
 - charge of 0; mass approximately 1×10^3 amu; located inside the nucleus
18. How many nanoliters are in 1 L?
- 10^3
 - 10^6
 - 10^9
 - 10^{-6}
 - 10^{-9}

19. A property of sodium metal is:
- shiny or silvery appearance
 - reaction (often violently) with water
 - reaction with halogens to make 1:1 compounds
 - all of the above**
 - none of the above**
20. The nucleus is held together by
- electromagnetic radiation.
 - nuclear strong force.
 - electrostatic attraction.
 - gravitational force.
 - all of the above.**
21. A charged atom (-1) has 76 electrons and has a mass number (A) of 190. How many protons and neutrons are in the nucleus of this atom?
- 114 p 190 n
 - 115 p 75 n
 - 75 p 190 n
 - 75 p 115 n
 - 76 p 114 n
22. Which of the following pairs consists of an example of a mixture and an example of a pure substance?
- concrete, air
 - rubbing alcohol, liquid hand soap
 - salt water, helium gas
 - anhydrous ammonia, aluminum foil
 - air, motor oil
23. How much heat would be required to increase the temperature of 5.0 grams of water by 10.0 °C? The specific heat of water is 1 cal/g °C.
- 1 cal
 - 5 cal
 - 10 cal
 - 50 cal
 - 500 cal
24. What is the mass of 2.00 in³ of mercury? Note: The density of mercury is 13.6 g/cm³.
- 2.67 g
 - 27.2 g
 - 69.1 g
 - 223 g
 - 446 g

25. How many electrons are in an atom with electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^6$?
- 5
 - 8
 - 10
 - 11
 - 18
26. Which of the following is a *physical* change or property?
- oil floats on water
 - setting of concrete
 - iron rusts
 - digestion of protein
 - natural gas burns
27. Suppose 5.0 kcal is absorbed by equal masses of each of the following metals. Which of the metals would have the **smallest** temperature increase?
- Au:** 0.031 cal/g °C **Cu:** 0.091 cal/g °C **Fe:** 0.106 cal/g °C **Mg:** 0.245 cal/g °C
- Au
 - Cu
 - Fe
 - Mg
 - all would have the same temperature increase***
28. The atomic weight of hydrogen from the periodic table is 1.0079 amu. From this information, what is the likely *approximate* isotopic composition of naturally occurring hydrogen on earth?
- mostly protium (no neutrons)
 - mostly deuterium (1 neutron)
 - mostly tritium (2 neutrons)
 - equal amounts of protium, deuterium and tritium
 - equal amounts of protium and deuterium, with a lesser amount of tritium
29. Which of the following contains exactly 44 neutrons?
- Ti-22
 - I-131
 - Sc-44
 - ^{101}Ru
 - ^{78}Se

30. Which digit is uncertain in the following mass?

54.3210 g

- a. 0
- b. 1
- c. 2
- d. 3
- e. 4

31. Which of the following is equivalent to 75.0 grams?

- a. 7.50×10^{-4} mg
- b. 7.50×10^4 mg
- c. 7.50×10^7 mg
- d. 7500 mg
- e. 0.0750 mg

32. Arrange the following electromagnetic radiation in order of increasing energy:

red green infrared ultraviolet blue

I II III IV V

- a. $I < II < V < III < IV$
- b. $IV < III < V < II < I$
- c. $II < I < III < V < IV$
- d. $III < I < II < V < IV$
- e. $V < IV < II < I < III$

33. What is the electron configuration for an uncharged (neutral) cadmium atom?

- a. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10}$
- b. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$
- c. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
- d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$
- e. $1s^4 2s^4 2p^{12} 3s^4 3p^{12} 4s^4 3d^8$

34. Which is a spherically-shaped region of electron density?

- a. any orbital in an *s* subshell
- b. any orbital in a *p* subshell
- c. *3d* orbital
- d. *4f* orbital
- e. **none of the above**

35. Benzyl salicylate, a sunscreen, melts at 24°C and boils at 320°C. At which temperature would benzyl salicylate be a liquid?

- a. 0°C
- b. 20°C
- c. 500°C
- d. 0°F
- e. 212°F

36. Add the following numbers (all are mass measurements in g) and ensure the sum has the proper number of significant figures:

$$\begin{array}{r} 25.34 \\ 102. \\ + \underline{0.055} \end{array}$$

- a. 127
b. 127.395
c. 127.4
d. 127.40
e. 130
37. The density of a solution is 1.19 g/mL. What is the mass of 25 mL of this solution (with proper attention to correct significant digits)?
- a. 0.048 g
b. 21 g
c. 21.0 g
d. 29.8 g
e. 30 g
38. A calcium atom that has lost two electrons has the same number of electrons as a neutral atom of:
- a. Ti
b. Ar
c. Mg
d. K
e. Be
39. The temperature 70°F is about the same as
- a. 21 K
b. 70 K
c. 294 K
d. 343 K
e. 431 K
40. Convert 5.0×10^{-8} cm to units of Å. Note that 1 Å is exactly 10^{-10} m.
- a. 0.50 Å
b. 5.0 Å
c. 50 Å
d. 5.0×10^{-2} Å
e. 5.0×10^1 Å