

**Fall 2011**  
**CHEM 1110.40413**  
**Test 1, Form A**

Name: \_\_\_\_\_

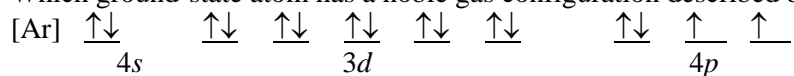
**Part I. Multiple Choice: Clearly circle the best answer. (60 pts)**

1. Which of the following cannot be separated into a simpler substance by chemical means?
  - A) Element
  - B) Compound
  - C) Homogeneous mixture
  - D) Heterogeneous mixture
  
2. Which of the following does not have a uniform composition throughout?
  - A) Element
  - B) Compound
  - C) Homogeneous mixture
  - D) Heterogeneous mixture
  
3. Isopropyl alcohol, commonly known as rubbing alcohol, boils at 82.4°C. What is the boiling point in Kelvin?
  - A) 355.6 K
  - B) 323.6 K
  - C) 190.8 K
  - D) -190.8 K
  
4. Which of the following is a chemical change?
  - A) Melting wax
  - B) Broiling a steak on a grill
  - C) Condensing water vapor into rainfall
  - D) Carving a piece of wood
  
5. Which one of these represents a *physical* change?
  - A) Water, when heated, forms steam
  - B) Bleach turns hair yellow
  - C) Milk turns sour
  - D) Apples, when exposed to air, turn brown
  
6. The result of  $(3.8621 \times 1.5630) - 5.98$  is properly written as
  - A) 0.06
  - B) 0.056
  - C) 0.0565
  - D) 0.05646
  
7. Select the answer that expresses the result of this calculation with the correct number of significant figures.
$$\frac{13.602 \times 1.90 \times 3.06}{4.2 \times 1.4097} =$$
  - A) 13.357
  - B) 13.36
  - C) 13.4
  - D) 13

8. Millikan's oil-drop experiment
- established the charge on an electron.
  - showed that all oil drops carried the same charge.
  - provided support for the nuclear model of the atom.
  - suggested the presence of a neutral particle in the atom.
9. What is the name used to represent the total number of neutrons and protons in the nucleus of each atom of an element?
- Isotope number
  - Mass number
  - Atomic number
  - Atomic mass units
10. Atoms X, Y, Z, and R have the following nuclear compositions. Which two are isotopes?
- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| ${}^{410}_{186}\text{X}$ | ${}^{410}_{183}\text{Y}$ | ${}^{412}_{186}\text{Z}$ | ${}^{412}_{185}\text{R}$ |
|--------------------------|--------------------------|--------------------------|--------------------------|
- X & Y
  - X & R
  - Y & R
  - X & Z
11. An atom of the isotope sulfur-31 consists of how many protons, neutrons, and electrons?
- 15 p, 16 n, 15 e
  - 16 p, 15 n, 16 e
  - 16 p, 31 n, 16 e
  - 16 p, 16 n, 15 e
12. Which of these elements is most likely to be a good conductor of electricity?
- N
  - He
  - Cl
  - Fe
13. Which of these elements is most chemically similar to magnesium, Mg?
- sulfur, S
  - calcium, Ca
  - iron, Fe
  - potassium, K
14. What is the name of the energy that results from the interaction of charged particles?
- thermal energy.
  - kinetic energy.
  - chemical energy.
  - electrostatic energy.
15. The size of an atomic orbital is associated with
- the principal quantum number ( $n$ ).
  - the angular momentum quantum number ( $l$ ).
  - the magnetic quantum number ( $m_l$ ).
  - the spin quantum number ( $m_s$ ).

16. The shape of an atomic orbital is associated with
- the principal quantum number ( $n$ ).
  - the angular momentum quantum number ( $l$ ).
  - the magnetic quantum number ( $m_l$ ).
  - the spin quantum number ( $m_s$ ).
17. The orientation in space of an atomic orbital is associated with
- the principal quantum number ( $n$ ).
  - the angular momentum quantum number ( $l$ ).
  - the magnetic quantum number ( $m_l$ ).
  - the spin quantum number ( $m_s$ ).
18. Which one of the following sets of quantum numbers is not possible?
- |    | $n$ | $l$ | $m_l$ | $m_s$ |
|----|-----|-----|-------|-------|
| A) | 4   | 3   | -2    | +1/2  |
| B) | 3   | 0   | 1     | -1/2  |
| C) | 3   | 0   | 0     | +1/2  |
| D) | 2   | 1   | 1     | -1/2  |
19. What is the maximum number of electrons in an atom that can have the following set of quantum numbers:  $n = 4$ ,  $l = 3$ ,  $m_l = -2$ ,  $m_s = +1/2$ ?
- 1
  - 2
  - 6
  - 10
20. A possible set of quantum numbers for the last electron added to complete an atom of gallium Ga in its ground state is
- |    | $n$ | $l$ | $m_l$ | $m_s$ |
|----|-----|-----|-------|-------|
| A) | 3   | 1   | 0     | -1/2  |
| B) | 4   | 1   | 0     | +1/2  |
| C) | 3   | 1   | 1     | +1/2  |
| D) | 4   | 2   | 1     | +1/2  |
21. The Pauli Exclusion Principle states that no \_\_\_ electrons within an atom can have the same \_\_\_ quantum numbers.
- 4, 4
  - 2, 4
  - 4, 6
  - 2, 6
22. Atomic orbitals that have the same amount of energy are \_\_\_\_\_.
- Regenerative
  - Negatively Charged
  - Degenerate
  - Positively Charged

23. Which ground-state atom has a noble gas configuration described by the following *orbital diagram*?



- A) phosphorus, P
- B) germanium, Ge
- C) selenium, Se
- D) tellurium, Te

24. How many unpaired electrons does a ground-state atom of sulfur have?

- A) 0
- B) 2
- C) 3
- D) 4

25. Which element has the following ground-state electron configuration:  $1s^2 2s^2 2p^6 3s^2$ ?

- A) Na
- B) Mg
- C) Al
- D) Si

26. Which element has the following noble gas configuration:  $[\text{Kr}]5s^2 4d^{10} 5p^2$ ?

- A) Sn
- B) Sb
- C) Pb
- D) Ge

27. The noble gas configuration of a ground-state chromium, Cr, atom is

- A)  $[\text{Ar}]4s^1 4d^5$
- B)  $[\text{Ar}]4s^2 4p^6$
- C)  $[\text{Ar}]4s^1 3d^5$
- D)  $[\text{Ar}]3d^5$

28. What is the electron configuration for bromine, Br?

- A)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 4d^{10} 4p^6$
- B)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10} 4p^6$
- C)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$
- D)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

29. The electronic structure  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$  refers to the ground state of

- A) Kr
- B) Ni
- C) Fe
- D) Pd

30. The noble gas configuration of a ground-state Co atom is

- A)  $[\text{Ar}]4s^2 3d^7$
- B)  $[\text{Ar}]3s^2 3d^7$
- C)  $[\text{Ar}]4s^1 3d^5$
- D)  $[\text{Ar}]4s^2 4d^7$



5. (10 pts) A photon associated with red light has a wavelength 699 nm ( $c = 3.00 \times 10^8$  m/s;  $h = 6.63 \times 10^{-34}$  J•s)?

a. What is the frequency (in  $s^{-1}$ ) of this photon?

b. What is the energy (in J) of this photon?

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	<table border="1"> <tr> <td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>63</td><td>64</td><td>65</td><td>66</td><td>67</td><td>68</td><td>69</td><td>70</td> </tr> <tr> <td><b>La</b></td><td><b>Ce</b></td><td><b>Pr</b></td><td><b>Nd</b></td><td><b>Pm</b></td><td><b>Sm</b></td><td><b>Eu</b></td><td><b>Gd</b></td><td><b>Tb</b></td><td><b>Dy</b></td><td><b>Ho</b></td><td><b>Er</b></td><td><b>Tm</b></td><td><b>Yb</b></td> </tr> <tr> <td>138.9</td><td>140.1</td><td>140.9</td><td>144.2</td><td>[145]</td><td>150.4</td><td>152</td><td>157.3</td><td>158.9</td><td>162.5</td><td>164.93</td><td>167.3</td><td>168.9</td><td>173</td> </tr> <tr> <td>89</td><td>90</td><td>91</td><td>92</td><td>93</td><td>94</td><td>95</td><td>96</td><td>97</td><td>98</td><td>99</td><td>100</td><td>101</td><td>102</td> </tr> <tr> <td><b>Ac</b></td><td><b>Th</b></td><td><b>Pa</b></td><td><b>U</b></td><td><b>Np</b></td><td><b>Pu</b></td><td><b>Am</b></td><td><b>Cm</b></td><td><b>Bk</b></td><td><b>Cf</b></td><td><b>Es</b></td><td><b>Fm</b></td><td><b>Md</b></td><td><b>No</b></td> </tr> <tr> <td>[227]</td><td>232</td><td>[231]</td><td>238</td><td>[237]</td><td>[244]</td><td>[243]</td><td>[247]</td><td>[247]</td><td>[251]</td><td>[252]</td><td>[257]</td><td>[258]</td><td>[259]</td> </tr> </table>																		57	58	59	60	61	62	63	64	65	66	67	68	69	70	<b>La</b>	<b>Ce</b>	<b>Pr</b>	<b>Nd</b>	<b>Pm</b>	<b>Sm</b>	<b>Eu</b>	<b>Gd</b>	<b>Tb</b>	<b>Dy</b>	<b>Ho</b>	<b>Er</b>	<b>Tm</b>	<b>Yb</b>	138.9	140.1	140.9	144.2	[145]	150.4	152	157.3	158.9	162.5	164.93	167.3	168.9	173	89	90	91	92	93	94	95	96	97	98	99	100	101	102	<b>Ac</b>	<b>Th</b>	<b>Pa</b>	<b>U</b>	<b>Np</b>	<b>Pu</b>	<b>Am</b>	<b>Cm</b>	<b>Bk</b>	<b>Cf</b>	<b>Es</b>	<b>Fm</b>	<b>Md</b>	<b>No</b>	[227]	232	[231]	238	[237]	[244]	[243]	[247]	[247]	[251]	[252]	[257]	[258]	[259]
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