This exam consists of 30 questions on 5 pages.

Fill in the bubble sheet as follows using a #2 pencil:
1. PRINT your first and last name
2. PRINT your net ID
3. PRINT your Student ID number
4. FILL IN the boxes with your Student ID number
5. BUBBLE the correct circles below Student ID characters
6. FILL IN your recitation section number (it’s here below by TA name if you don’t know it)
7. BUBBLE the correct circles for your section number

Teaching Assistants and Recitation Sections

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Rules for the Exam:
1. There is only one correct answer to each question. Any questions for which more than one response has been filled on the bubble sheet will not be counted. The score is based solely on the number of questions you answer correctly.
2. Only answers that are colored in on the bubble sheet count. Appeals based on answers circled on the exam paper, with a different answer indicated on the bubble sheet, will not result in a score change.
Formulas and Equations

\[ ^\circ F = \frac{9}{5}(^\circ C) + 32 \quad ^\circ C = \frac{5}{9}(^\circ F - 32) \quad \text{Kelvin} = 0 ^\circ C + 273.15 \]

Avogadro’s Number, \( N_A = 6.022 \times 10^{23} \)

Density of water = 1.000 g/ml at 25 °C

1 ft = 12 in  \quad 1 in = 2.54 cm  \quad 100 cm = 1 m  \quad 1,000 mm = 1 m

1 pm = 10^{-12} m  \quad 1 nm = 10^{-9} m  \quad 1 cm^3 = 1 mL  \quad 1,000 mg = 1 g
1. A helicopter was reported to have been spotted at an altitude of 12,600 ft. before disappearing into the clouds on a stormy day. How many meters is this? (1 m = 1.0936 yd, 1 yd = 3 ft)
   A) 3,841 m    B) 4,593 m    C) 34,565 m    D) 41,338 m

2. During a routine visit to the doctor, a patient was found to have fever of 103.5 °F. What is this temperature in °C?
   A) 376.5 °C    B) 73.58 °C    C) 39.72 °C    D) 37.95 °C

3. A temperature of 294.15 Kelvin was recorded as the highest, on a hot day in Clear Lake, IA. What is this temperature in °F?
   A) 21.0 °F    B) 69.8 °F    C) 90.8 °F    D) 273 °F

4. Given the density of gold as 19.3 g/cm$^3$, what is the mass of a gold bar that is $7.379 \times 10^{-4}$ m$^3$ in volume? (1 m = 100 cm)
   A) $1.42 \times 10^4$ g    B) $1.424 \times 10^{-2}$ g    C) $2.616 \times 10^2$ g    D) $2.62 \times 10^{-4}$ g

5. A runner completes a 10K (10.0 km) road race in 44 minutes and 55 seconds. What is the runner's average speed in miles per hour? (1 km = 0.621 miles)
   A) 6.21 mi/hr    B) 7.49 mi/hr    C) 8.29 mi/hr    (C) 9.82 mi/hr

6. When you place a piece of dry ice (solid carbon dioxide) on a plate at room temperature, you notice that no liquid forms, unlike ice that melts to form liquid water. This is because dry ice __
   A) as a liquid quickly evaporates.
   B) undergoes deposition instead of melting.
   C) sublimes instead of melting.
   D) contains no water.

7. A student performed three measurements to determine the density of water at 25 °C to three significant figures. She obtained the results as 2.01 g/mL, 1.95 g/mL, and 2.10 g/mL. If the known density of water at 25 °C to three significant figures is 0.958 g/mL, the measurements obtained by the student can be described as:
   A) accurate    B) precise    C) accurate and precise    D) neither accurate nor precise

8. Filtration can be used to separate components in a mixture based on differences in
   A) solubility    B) particle size    C) boiling point    D) melting point

9. Which of the following is an element?
   A) CO    B) KI    C) H$_2$O    D) He
Use the diagram below to answer questions 10-12.

10. Identify a letter that corresponds to halogens
   A   B   C   D

11. Identify a letter that corresponds to alkaline earth metals
    A   B   C   D

12. Identify a letter that corresponds to noble gases
    A   B   C   D

13. Which answer has the element name and symbol correctly matched?
    (A) copper, Co       (B) potassium, P       (C) selenium, Se       (D) sodium, Sa

14. Which pair of elements both have chemical properties similar to that of carbon?
    A) N, O       B) H, O       C) Si, Ge       D) Mn, Ca

15. Consider the ions $^{19}\text{F}^-$, $^{23}\text{Na}^+$ and $^{24}\text{Mg}^{2+}$. These ions have:
    A) the same number of protons
    B) the same number of electrons
    C) the same number of neutrons
    D) the same number of protons and neutrons

16. In which compound can the bonds be described as covalent?
    A) NaCl       B) MgF$_2$       C) SrCl$_2$       D) CO$_2$

17. In which compound can the bonds be described as both ionic and covalent?
    A) CS$_2$       B) NH$_3$       C) KBr       D) Na$_2$SO$_3$

18. Chlorine reacts with X to form XCl$_3$. What is the best choice for identity of X
    A) sodium       B) magnesium       C) aluminum       D) silicon

19. How many atoms of each element are there in the compound Na$_3$(PO$_4$)$_3$?
    A) sodium 3, phosphorus 3, oxygen 12
    B) sodium 9, phosphorus 3, oxygen 12
    C) sodium 3, phosphorus 1, oxygen 4
    D) sodium 3, potassium 1, oxygen 4
20. Complete the following statement. “Isotopes are different forms of the same element, with nuclei that have the same number of protons but different numbers of ________. 
A) neutrons  B) electrons  C) charges  D) bond order

21. Provide the number of protons, neutrons, and electrons in \(^{70}\text{Br}^-\) isotope. 
A) 45 protons, 34 neutrons, and 36 electrons  
B) 79 protons, 35 neutrons, and 44 electrons 
C) 35 protons, 44 neutrons, and 36 electrons 
D) 44 protons, 35 neutrons, and 35 electrons

22. There are two stable isotopes of gallium. Their masses are 68.9256 and 70.9247 amu. If the average atomic mass of gallium is 69.7231 amu, what is the natural abundance of the heavier isotope? 
A) 11.44 %  B) 88.56%  C) 39.89 %  D) 60.11%

23. Which ion has the same number of electrons as an atom of argon? 
A) Sb\(^{3-}\)  B) O\(^{2-}\)  C) S\(^{2-}\)  D) Be\(^{2+}\)

24. The following salts are used in fireworks. Which one has an incorrect formula? 
A) BaNO\(_3\), barium nitrate  C) CuO, copper(II) oxide 
B) CaSO\(_4\), calcium sulfate  D) NH\(_4\)Cl, ammonium chloride

25. What is the chemical formula of potassium carbonate? 
A) K\(_2\)CO\(_3\)  B) KCO\(_3\)  C) K\(_3\)CO\(_2\)  D) P\(_3\)(CO\(_3\))\(_2\)

26. What is the name of Na\(_2\)Cr\(_2\)O\(_7\)? 
A) sodium chromium oxide  C) sodium chromate 
B) sodium dichromate  D) sodium chromoxide

27. What is the name of KMnO\(_4\)? 
A) potassium permanganate  C) potassium manganate 
B) potassium (IV) manganite  D) potassium (II) permanganate

28. What is the chemical formula for hydrobromic acid? 
A) HBr  B) HOBr  C) HOBr\(_3\)  D) HCl

29. Which of the following statements is true about carbon-carbon bonds? 
A) Carbon-carbon single bonds are shorter than carbon-carbon triple bonds 
B) Carbon-carbon triple bonds are stronger than carbon-carbon single bonds 
C) Carbon-carbon double bonds are longer than carbon-carbon single bonds 
D) Carbon-carbon double bonds are stronger than carbon-carbon triple bonds

30. True or False. I have correctly filled out the identification section of my bubble sheet with my ISU student ID and section number. 
(A) True  (B) False