Numerical constants may be listed below. Other needed information is given in the problem or written on the board or found in the Periodic Tables you will use during exam. For numerical problems, be sure to show your work, include units and circle your final answer. If several choices are given, circle the correct answer. Your written answers should be brief and to the point. You can use your own calculator on the exam, but no notes, books, external information, or other electronic devices are to be used. No cell phone is to be used in Exam room.

\[ 1 \text{ g} = 6.02 \times 10^{23} \text{ amu} \quad ^{0}\text{C}=\left(^{0}\text{F}-32\right)/1.8 \quad K=^{0}\text{C}+273 \]

1) What is the most important idea in science - the central idea of chemistry?

Everything is made of atoms

2) Identify the following as a chemical or physical change

the temperature of liquid mercury is lowered and it changes to solid - physical
mercury combines with fluorine to make mercury (II) fluoride - chemical

3) Write formulas and balance the following chemical reaction

methane + oxygen → carbon dioxide + water

\[ \text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} \]

4) Write the answer to the correct number of significant figures

\[
\frac{(8.7124 \times 0.0301)}{(2.731 + 1.056)} = \frac{0.262}{3.787} = 0.0692 \text{ or } 6.92 \times 10^{-2}
\]

5) The density of water is 1.00 g/mL. Given that one ton is 2000 pounds (lb) and that one pound is equivalent to 454 grams then a tanker truck carrying 2.50 tons of water would have a volume of how many liters (L)?

? L = 2.50 tons \left( \frac{2000 \text{ lb}}{\text{ton}} \right) \left( \frac{454 \text{ g}}{1 \text{ lb}} \right) \left( \frac{\text{ml}}{1 \text{ g}} \right) \left( \frac{10^3 \text{ L}}{1 \text{ ml}} \right)

= \frac{2270}{3} \text{ L}

= \frac{2.27 \times 10^3}{1} \text{ L}
6) The idea that wood after burning left only a small amount of ash so therefore heat must be a substance that left the wood was associated with practical arts Greek alchemy phlogiston modern chemistry

7) Why would Mendeleev have switched the positions of Te and I in the Periodic Table?
Because Te has a higher atomic mass than I.

8) Write the correct symbol for the following elements
sulfur - S lanthanum - La

9) Write the correct symbol for the following elements
iron - Fe magnesium - Mg

10) You take the temperature of a person with a fever and find it to be 103.4 °F then what is it in Celsius (°C)?

\[
\begin{align*}
&= \frac{103.4 - 32.0}{1.8} \\
&= 39.7 °C
\end{align*}
\]

11) If an element has two isotopes whose natural abundance and exact masses are given as

<table>
<thead>
<tr>
<th>Fractional Abundance</th>
<th>Mass (amu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.4%</td>
<td>185</td>
</tr>
<tr>
<td>62.6%</td>
<td>187</td>
</tr>
</tbody>
</table>

then the average atomic weight of this element is

\[
\text{to 3 sig fig} \quad 186.3
\]
or to 4 sig fig

12) Identify the number of neutrons and electrons in the atom

\[
\begin{align*}
#n &= 80 \\
#e &= 54
\end{align*}
\]

13) What information was gained about the internal structure of the atom from Rutherford's 1911 gold foil experiment?

- All positive charge found in a small part of atom
- Positive charge spread throughout atom
- Neutrons in nucleus
- Atoms made of electrons and protons

14) Name the following compounds

NaF sodium fluoride Cu₂O copper (I) oxide

15) Name the following compounds

(NH₄)₂SO₄ ammonium sulfate Zn(CN)₂ zinc (II) cyanide
16) Write the compound formulas indicated by the following names

dinitrogen oxide (laughing gas, used as a dental anesthetic) - \( \text{N}_2\text{O} \)

uranium hexafluroide - \( \text{UF}_6 \)

17) Write the compound formulas for

sodium hypochlorite (bleach) - \( \text{NaClO} \)

aluminum nitrate - \( \text{Al}(\text{NO}_3)_3 \)

18) The correct dosage of gentamicin (an antibiotic medicine given by injection or IV) is 3.00 mg of drug for every 1.00 kg of body weight. A 128 lb person should be given \( \frac{3.00 \text{ mg drug}}{1.00 \text{ kg}} \times \frac{128 \text{ lb}}{454 \text{ g}} \) mg of this medicine. Recall that 454 g = 1 pound.

\[
? \text{ mg drug} = 128 \text{ lb} \left( \frac{454 \text{ g}}{1 \text{ lb}} \right) \left( \frac{12 \text{ g}}{10^3 \text{ g}} \right) \left( \frac{3.00 \text{ mg drug}}{1.00 \text{ kg}} \right)
= 174 \text{ mg drug}
\]

19) Which of the following elements is not normally found as a diatomic molecule in pure form

\( \text{Ni} \quad \text{N} \quad \text{O} \quad \text{Cl} \quad \text{Br} \)

20) Alpha and beta particles are deflected in opposite directions when moving through a magnetic field because

- they have different masses
- they have opposite spin
- they have opposite charges
- one is radioactively active
- one has more energy

21) (a) Draw the structure of ethanol

(\( \text{CH}_3\text{CH}_2\text{OH} \))

(b) and what is \( \text{C}_6\text{H}_{14} \) called

hexane

22) Which of the following is a metalloid

\( \text{Na} \quad \text{Mg} \quad \text{Si} \quad \text{S} \quad \text{Cl} \quad \text{Ar} \)

and which of the following is a halogen

\( \text{Na} \quad \text{Mg} \quad \text{Si} \quad \text{S} \quad \text{Cl} \quad \text{Ar} \)

23) Which of the following is an alkali metal

\( \text{Na} \quad \text{Mg} \quad \text{Si} \quad \text{S} \quad \text{Cl} \quad \text{Ar} \)

and which of the following nonmetals would tend to form ions with a -2 charge

\( \text{Na} \quad \text{Mg} \quad \text{Si} \quad \text{S} \quad \text{Cl} \quad \text{Ar} \)