

Name: _____

- 1) Experimental evidence indicates that the nucleus of an atom
- contains a small percentage of the mass of the atom
 - contains most of the mass of the atom
 - has no charge
 - has a negative charge
- 2) What particle has approximately the same mass as a proton?
- electron
 - neutron
 - beta
 - alpha
- 3) What is the number of protons present in the nucleus of the atom below?
- $${}_{27}^{59}\text{Co}$$
- 27
 - 86
 - 32
 - 59
- 4) Which pair of atoms contain the same number of neutrons?
- ${}^3_1\text{H}$ and ${}^3_2\text{He}$
 - ${}^3_1\text{H}$ and ${}^4_2\text{He}$
 - ${}^2_1\text{H}$ and ${}^4_2\text{He}$
 - ${}^1_1\text{H}$ and ${}^3_2\text{He}$
- 5) Which pair of atoms are isotopes?
- ${}^7_3\text{Li}$ and ${}^9_4\text{Be}$
 - ${}^{22}_{11}\text{Na}$ and ${}^{23}_{11}\text{Na}$
 - ${}^3_1\text{H}$ and ${}^3_2\text{He}$
 - ${}^{14}_6\text{C}$ and ${}^{14}_7\text{N}$
- 6) The characteristic bright-line spectrum of an element is produced when its electrons
- form an ionic bond
 - return to a lower energy state
 - move to a higher energy state
 - form a covalent bond
- 7) What is the atomic number of an atom that forms an ion with 18 electrons and a charge of 2+?
- 18
 - 20
 - 48
 - 30
- 8) What is the correct electron-dot representation of an atom of sulfur in the ground state?
- $\text{S}::$
 - $\cdot\text{S}::$
 - $::\text{S}::$
 - $\cdot\text{S}::$
- 9) In an atom that has an electron configuration of 2-5, what is the total number of electrons in its *highest* energy level?
- 5
 - 2
 - 8
 - 7
- 10) Which of the following is the electron configuration for Mg^{2+} ions?
- 2-8-2
 - 2-2
 - 2-8
 - 2-8-8
- 11) In the Periodic Table of the Elements, *all* the elements within Group 16 have the same number of
- protons
 - valence electrons
 - neutrons
 - energy levels
- 12) An atom of an element has 28 innermost electrons and 7 outermost electrons. In what period of the Periodic Table is this element located?
- 5
 - 2
 - 3
 - 4

- 13) The pair of elements with the *most* similar chemical properties are
 A) Ca and Br C) Mg and S
 B) Mg and Ca D) S and Ar
- 14) As the elements of Group 16 are considered from top to bottom on the Periodic Table, the atomic radii
 A) decrease and the ionization energies increase
 B) decrease and the ionization energies decrease
 C) increase and the ionization energies decrease
 D) increase and the ionization energies increase
- 15) When a metal reacts with a nonmetal, the metal will
 A) lose electrons and form a positive ion
 B) gain electrons and form a negative ion
 C) lose protons and form a positive ion
 D) gain protons and form a negative ion
- 16) Which element in Group 17 is the *most* active nonmetal?
 A) I C) F
 B) Cl D) Br
- 17) The metalloids that are included in Group 15 are antimony (Sb) and
 A) N C) As
 B) P D) Bi
- 18) Which Group 15 elements can lose an electron *most* readily?
 A) P C) Sb
 B) N D) Bi
- 19) In which group of elements do the atoms gain electrons *most* readily?
 A) 1 C) 16
 B) 2 D) 18
- 20) Which of the following is the atomic number of an alkali metal?
 A) 11 C) 13
 B) 12 D) 10
- 21) In what classification is an element placed if its ground state electron configuration is 2-8-13-2?
 A) alkaline earth metals
 B) transition metals
 C) metalloids (semimetals)
 D) nonmetals
- 22) Which formula represents a binary compound?
 A) H₂SO₄ C) Br₂
 B) Ne D) C₃H₈
- 23) Which bond has the *greatest* degree of ionic character?
 A) F—F C) Li—Br
 B) H—Cl D) S—O
- 24) Which compound is ionic?
 A) N₂O C) CaCl₂
 B) HCl D) SO₂
- 25) A substance was found to be a soft, nonconducting solid at room temperature. The substance is *most* likely
 A) a metallic solid
 B) an ionic solid
 C) a network solid
 D) a molecular solid
- 26) Which molecule contains a nonpolar covalent bond?
 A) $\begin{array}{c} \bullet\bullet \\ \text{H} \times \text{N} \times \text{H} \\ \bullet\bullet \\ \times \\ \text{H} \end{array}$ C) $\begin{array}{c} \bullet\bullet \\ \text{H} \times \text{Cl} \bullet \\ \bullet\bullet \end{array}$
 B) $\begin{array}{c} \bullet\bullet \\ \text{H} \times \text{O} \bullet \\ \bullet\bullet \\ \times \\ \text{H} \end{array}$ D) $\text{H} \times \text{H}$
- 27) The bond between hydrogen and oxygen in a water molecule is classified as
 A) ionic and nonpolar
 B) covalent and polar
 C) ionic and polar
 D) covalent and nonpolar
- 28) Which molecule is nonpolar and has a symmetrical shape?
 A) HCl C) H₂O
 B) NH₃ D) CH₄

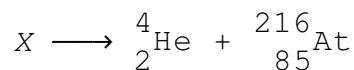
- 29) A molecule with the electron-dot formula $\begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \text{H} \cdot \cdot \text{O} \cdot \cdot \\ \cdot\cdot \\ \text{H} \end{array}$ is
- A) symmetrical C) polar
B) nonpolar D) linear
- 30) Which substance contains positive ions immersed in a sea of mobile electrons?
- A) SiO₂(s) C) CuO(s)
B) O₂(s) D) Cu(s)
- 31) The table below shows four compounds and the boiling point of each.

Compound	Boiling Point
H ₂ O	100.°C
H ₂ S	-60.7°C
H ₂ Se	-41.5°C
H ₂ Te	-2.2°C

Which type of molecular attraction accounts for the high boiling point of H₂O?

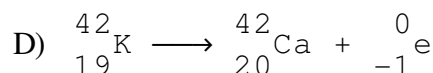
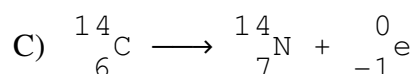
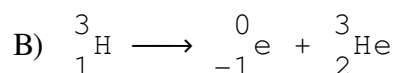
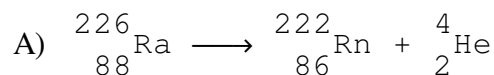
- A) ion-ion
B) molecule-ion
C) hydrogen bonding
D) dispersion forces
- 32) Molecule-ion attractions are found in
- A) KBr(l) C) NaCl(aq)
B) CO(g) D) Cu(s)
- 33) Which sequence of Group 18 elements demonstrates a gradual decrease in the strength of intermolecular forces of attraction?
- A) Xe(l), Kr(l), Ar(l), Ne(l)
B) Kr(l), Xe(l), Ar(l), Ne(l)
C) Ar(l), Kr(l), Ne(l), Xe(l)
D) Ne(l), Ar(l), Kr(l), Xe(l)
- 34) Samples of elements that are radioactive *must* contain atoms
- A) with stable nuclei
B) with unstable nuclei
C) in the excited state
D) in the ground state

- 35) Given the equation:

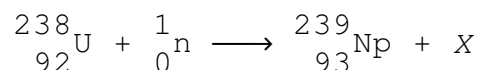


What element is represented by the letter X?

- A) Fr C) Ra
B) Rn D) Bi
- 36) Which nuclear reaction is classified as alpha decay?



- 37) Given the equation:

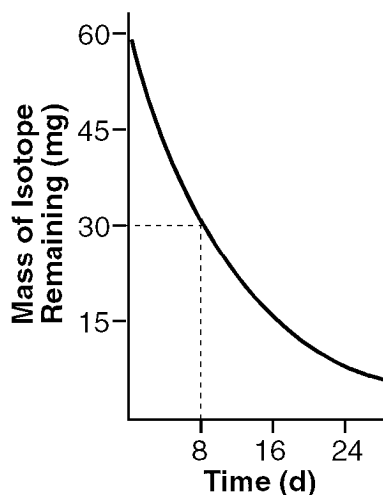


The species represented by the letter X is

- A) ${}^4_2\text{He}$ C) ${}^1_1\text{H}$
B) ${}^0_{-1}\text{e}$ D) ${}^1_0\text{n}$
- 38) Bombarding a nucleus with high-energy particles that change it from one element into another is called
- A) artificial transmutation
B) a half-reaction
C) a breeder reaction
D) natural transmutation
- 39) Compared to an ordinary chemical reaction, a fission reaction will
- A) release larger amounts of energy
B) release smaller amounts of energy
C) absorb larger amounts of energy
D) absorb smaller amounts of energy

- 40) What conditions are required to form He-4 during the fusion reaction in the Sun?
- high temperature and high pressure
 - high temperature and low pressure
 - low temperature and low pressure
 - low temperature and high pressure

- 41) The graph below represents the decay of a radioactive isotope.



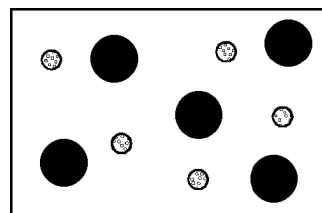
Based on the *Selected Radioisotopes* chemistry reference table, which radioisotope is *best* represented by the graph?

- | | |
|---------------------|----------------------|
| A) ^{32}P | C) ^{222}Rn |
| B) ^{131}I | D) ^{198}Au |
- 42) In 6.20 hours, a 100. gram sample of Ag-112 decays to 25.0 grams. What is the half-life of Ag-112?
- | | |
|---------------|---------------|
| A) 12.4 hours | C) 6.20 hours |
| B) 3.10 hours | D) 1.60 hours |
- 43) What element is used for dating archaeological discoveries?
- | | |
|--------------|--------------|
| A) carbon-15 | C) carbon-12 |
| B) carbon-13 | D) carbon-14 |
- 44) Which particle can *not* be accelerated in a magnetic field?
- | | |
|------------------|-------------------|
| A) proton | C) alpha particle |
| B) beta particle | D) neutron |

- 45) In the nuclear reactor, the radioisotope U-235 serves as a

- coolant
- fissionable material
- shield
- neutron absorber

- 46) The particle diagram below represents a sample of matter.



Which *best* describes the composition of the sample?

- a mixture of elements
 - a single element
 - a mixture of compounds
 - a single compound
- 47) Which formula represents a mixture?
- | | |
|-----------------------------|----------------------------|
| A) $\text{NH}_3(\text{aq})$ | C) $\text{NH}_3(\ell)$ |
| B) $\text{NH}_3(\text{s})$ | D) $\text{NH}_3(\text{g})$ |
- 48) Which substance can *not* be decomposed by a chemical change?
- mercury (II) oxide
 - water
 - potassium chlorate
 - copper
- 49) Which *best* describes exothermic chemical reactions?
- They always occur spontaneously.
 - They never release heat.
 - They never occur spontaneously.
 - They always release heat.
- 50) What is the total amount of heat energy released when 200 grams of water is cooled from $50.^\circ\text{C}$ to 25°C ? [*Specific Heat of Water* = $4.18 \text{ J/g} \cdot \text{k}$]
- | | |
|------------------|------------------|
| A) 20,900 joules | C) 41,800 joules |
| B) 4 joules | D) 8 joules |

51) A 1-gram sample of which substance in a sealed 1-liter container will occupy the container completely and uniformly?

- A) Ag(s) C) Hg(l)
 B) H₂O(g) D) H₂O(l)

52) At 1 atmosphere, which substance will sublime when heated?

- A) HCl(aq) C) H₂O(l)
 B) CO₂(s) D) CH₄(g)

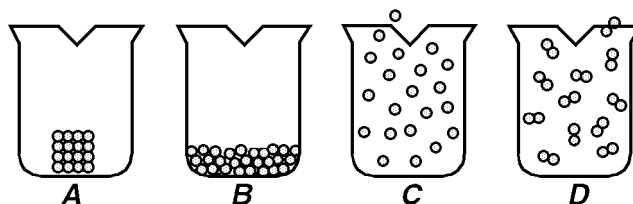
53) How many joules of heat are absorbed when 50.00 grams of H₂O(l) at its boiling point are completely vaporized? (heat of vaporization = 2,259 J/g)

- A) 22,590 C) 112,950
 B) 225,900 D) 2,259

54) Which phase change is endothermic?

- A) liquid to gas C) gas to liquid
 B) liquid to solid D) gas to solid

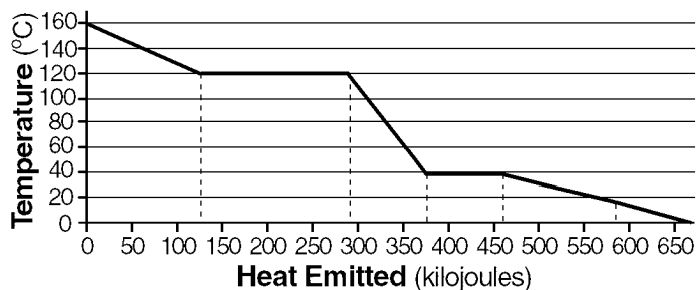
56) The particle diagrams below represent elements at STP.



Which particle diagram *best* represents mercury?

- A) A B) B C) C D) D

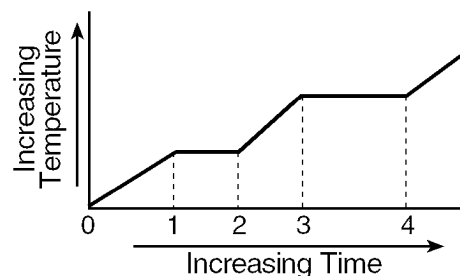
57) The graph below represents the uniform cooling of a substance starting as a gas at 160°C.



At which temperature does a phase change occur for this substance?

- A) 40°C B) 0°C C) 80°C D) 140°C

55) The graph below represents the relationship between the temperature and time for a substance that was heated uniformly starting at t_0 . The substance was in the solid phase at t_0 .



During what time interval does the heat absorbed by the substance represent the heat of fusion of the substance?

- A) t_2 to t_3 C) t_1 to t_2
 B) t_0 to t_1 D) t_3 to t_4

