

Unit 2

Test

DEF: Foundations of Chemistry

Total Marks: 65

Name _____

- Which property of the particles that make up matter is most closely related to the concept of temperature?
 - Their volume
 - Their density
 - Their motion
 - Their ionization energy

- Why do metals expand when they are heated?
 - Their atoms become larger.
 - Their atoms move further apart from each other.
 - Their atoms become both larger and further apart.
 - A cow. Or maybe a dog. You know, sometimes, their just are not four options...

- Ice melts at precisely 0°C . What can be inferred about the freezing point of water?
 - It is also precisely 0°C .
 - It is slightly greater than 0°C
 - It is slightly less than 0°C .
 - The freezing point cannot be inferred from the melting point.

- Why is oxygen (O_2) considered to be a pure substance rather than a mixture?
 - It is composed of one kind of element.
 - It is composed of two kinds of elements.
 - It is composed of one kind of molecule.
 - It is composed of two kinds of molecules.

- Distillation is a separation technique that depends upon differences in
 - density
 - boiling point
 - particle size
 - adherence to an absorbent material

- Compare the particles in a liquid to the particles in a gas in terms of how they are ordered and their degree of motion.
 - The liquid particles are more ordered and have more motion.
 - The gas particles are more ordered and have less motion.
 - The liquid particles are less ordered and have less motion.
 - The gas particles are less ordered and have more motion.

7. Which of the following elements are liquids at room temperature?
- A. iodine and mercury
 - B. bromine and mercury
 - C. iodine and cesium
 - D. bromine and cesium
8. Consider the elements Al, Si, Ga, and Ge. Which of these four elements most easily gives up a valence electron?
- A. Al
 - B. Si
 - C. Ga
 - D. Ge
9. Which Group 1 element reacts the most slowly on contact with water?
- A. lithium
 - B. sodium
 - C. potassium
 - D. cesium
10. Which best describes the element fluorine?
- A. a gas, reactive, diatomic
 - B. a gas, inert, monatomic
 - C. reactive, diatomic, larger than chlorine
 - D. inert, monatomic, larger than chlorine
11. Which subatomic particle has the least mass?
- A. proton
 - B. electron
 - C. neutron
 - D. the nucleus
12. Consider the following four elements: As, Se, Sb, and Te. Which of the four has the larger atomic radius?
- A. As
 - B. Se
 - C. Sb
 - D. Te

13. Compare and contrast helium-5 and lithium-6
- A. they have the same number of protons and different a number of neutrons
 - B. they have the same number of neutrons and a different number of protons
 - C. they have the same number of electrons and a different number of protons
 - D. they have the same number of electrons and a different number of neutrons.
14. How many protons are found in the nucleus of hydrogen-2 ?
- A. none
 - B. one
 - C. two
 - D. three
15. What is the atomic number and identity of an atom with 21 protons and a mass number of 41?
- A. 21; scandium
 - B. 21, niobium
 - C. 41, scandium
 - D. 41, calcium
16. How many neutrons and protons are in ^{81}Br ?
- A. 35 neutrons and 35 protons
 - B. 46 neutrons and 46 protons
 - C. 46 neutrons and 35 protons
 - D. 81 neutrons and 46 protons
17. Which compound contains an ionic bond?
- A. NH_3
 - B. $(\text{NH}_4)_2\text{SO}_4$
 - C. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
 - D. XeF_6
18. Which of the following is both a molecule and a compound?
- A. NaCl
 - B. H_2O
 - C. S_8
 - D. C
19. Which compound contains covalent bonds
- A. Fe_2S_3
 - B. SF_2
 - C. RbF
 - D. FeF_2

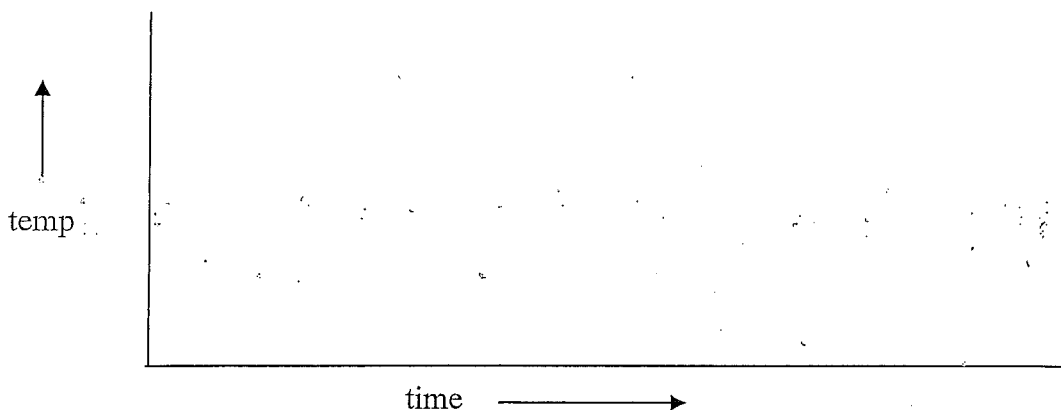
20. What is the name of the tin ion in SnSe_2 ?
- A. tin
 - B. tin(II)
 - C. tin(III)
 - D. tin(IV)
21. Which type of bond is formed between two atoms of oxygen in O_2 ?
- A. single bond
 - B. double bond
 - C. triple bond
 - D. quadruple bond
22. What is the charge on the gold ion in Au_2S_3 ?
- A. 0
 - B. 1+
 - C. 2+
 - D. 3+
23. What is the formula for potassium phosphate?
- A. KPO
 - B. K_2PO_3
 - C. K_4PO
 - D. K_3PO_4
24. What is the formula for lead(IV) hypochlorite?
- A. Pb(IV)ClO
 - B. Pb_4ClO
 - C. PbClO_4
 - D. Pb(ClO)_4
25. What is the name of SO_3 ?
- A. sulfur trioxide
 - B. trisulfur monoxide
 - C. sulfate
 - D. sulfite

Written Response

Instructions: You will be expected to communicate your knowledge and understanding of chemical principles in a clear and logical manner.
Your steps and assumptions leading to a solution must be written in the spaces below the questions.
You must include units where appropriate and answers must be given to the correct number of significant figures.
For questions involving calculation, full marks will NOT be given for providing only the answer.

1. A block of lead metal is heated until it is converted completely into a gas. Sketch a graph showing the heating of this lead. Indicate on the graph where liquid and gaseous lead coexist and label where the melting of lead is occurring. (It is not necessary to include numbers in the sketch.)

(3 marks)



2. Explain, possibly with the use of a diagram, why a liquid will take on the shape of the container that it is in, but will not expand to fill the container. (2 marks)

3. ~~Paper chromatography is a physical separation technique that can be used to separate the several colours that are present in brown ink. How does paper chromatography accomplish this separation?~~

(2 marks)

4. How do the elements iodine and xenon differ in terms of reactivity, state at room temperature, and ionization energy?

(3 marks)

5. State the Periodic Law.

(2 marks)

6. Boron has two important isotopes: boron -11 and boron - 12. Explain how they are similar and how they are different by making reference to their atomic structure. (2 marks)

7. Use the following data provided to find the atomic mass of the element magnesium to three decimal places. Show your calculation. Do not round until the end. (2 marks)

| | Mass of Atom | Abundance in Nature |
|-------------|---------------------|----------------------------|
| chlorine-35 | 34.9689 amu | 75.77 % |
| chlorine-37 | 36.9659 amu | 24.27 % |

8. Explain why metals are ductile by making reference to the metallic bond.

(2 marks)

9. Moving from left to right across a period, the atomic radii steadily decrease. Explain why this is so, making reference to atomic structure in your explanation. (2 marks)

10. Draw Lewis (electron dot) structures for the following: (7 marks)



11 Complete the following tables.

(13 marks)

| Formula | Name |
|--------------------------------------|------|
| FeCl_2 | |
| $\text{Al}(\text{NO}_3)_3$ | |
| MnCl_2 | |
| KHCO_3 | |
| P_2S_4 | |
| $\text{Au}(\text{CH}_3\text{COO})_3$ | |
| NH_3 | |

| Name | Formula |
|--------------------------------|---------|
| dinitrogen monoxide | |
| calcium chloride penta hydrate | |
| argon trioxide | |
| calcium hydrogen sulphite | |
| sodium dichromate | |
| water | |

The End !!!

Unit 2

DEF: Foundations of Chemistry

Test

Total Marks: 65

Name KEY

1. Which property of the particles that make up matter is most closely related to the concept of temperature?

- A. Their volume
- B. Their density
- C. Their motion
- D. Their ionization energy

Greater motion corresponds to higher temperature

2. Why do metals expand when they are heated?

- A. Their atoms become larger.
- B. Their atoms move further apart from each other.
- C. Their atoms become both larger and further apart.
- D. A cow. Or maybe a dog. You know, sometimes, their just are not four options...

Atoms do not get larger with heating. They move faster and push apart.

3. Ice melts at precisely 0 °C. What can be inferred about the freezing point of water?

- A. It is also precisely 0 °C.
- B. It is slightly greater than 0 °C
- C. It is slightly less than 0 °C.
- D. The freezing point cannot be inferred from the melting point.

4. Why is oxygen (O₂) considered to be a pure substance rather than a mixture?

- A. It is composed of one kind of element.
- B. It is composed of two kinds of elements.
- C. It is composed of one kind of molecule.
- D. It is composed of two kinds of molecules.

5. Distillation is a separation technique that depends upon differences in

- A. density
- B. boiling point
- C. particle size
- D. adherence to an absorbent material

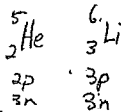
6. Compare the particles in a liquid to the particles in a gas in terms of how they are ordered and their degree of motion.

- A. The liquid particles are more ordered and have more motion.
- B. The gas particles are more ordered and have less motion.
- C. The liquid particles are less ordered and have less motion.
- D. The gas particles are less ordered and have more motion.

- 1 -

13. Compare and contrast helium-5 and lithium-6

- A. they have the same number of protons and different a number of neutrons
- B. they have the same number of neutrons and a different number of protons
- C. they have the same number of electrons and a different number of protons
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15. What is the atomic number and identity of an atom with 21 protons and a mass number of 41?

- A. 21; scandium
- B. 21; niobium
- C. 41; scandium
- D. 41; calcium

41? 21 protons ⇒ atomic # is 21
20 neutrons

16. How many neutrons and protons are in ⁸¹Br?

- A. 35 neutrons and 35 protons
- B. 46 neutrons and 46 protons
- C. 46 neutrons and 35 protons
- D. 81 neutrons and 46 protons

81 Br 35 protons
81 - 35 = 46 neutrons

17. Which compound contains an ionic bond?

- A. NH₃
- B. (NH₄)₂SO₄
- C. C₁₂H₂₂O₁₁
- D. XeF₄

NH₄⁺ in a compound makes it ionic

18. Which of the following is both a molecule and a compound?

- A. NaCl - compound
- B. H₂O - compound
- C. S₈ - element
- D. C - element

a group of atoms covalently bonded (non-metals) more than one element

19. Which compound contains covalent bonds

- A. Fe₂S₃
- B. SF₂
- C. RbF
- D. FeF₂

look for non-metals only in the compound

- 3 -

7. Which of the following elements are liquids at room temperature?

- A. iodine and mercury
- B. bromine and mercury
- C. iodine and cesium
- D. bromine and cesium

8. Consider the elements Al, Si, Ga, and Ge. Which of these four elements most easily gives up a valence electron?

- A. Al
- B. Si
- C. Ga
- D. Ge

lowest ionization energy

| | |
|----|----|
| Al | Si |
| Ga | Ge |

9. Which Group 1 element reacts the most slowly on contact with water?

- A. lithium
- B. sodium
- C. potassium
- D. cesium

10. Which best describes the element fluorine?

- A. a gas, reactive, diatomic
- B. a gas, inert, monatomic
- C. reactive, diatomic, larger than chlorine
- D. inert, monatomic, larger than chlorine

11. Which subatomic particle has the least mass?

- A. proton
- B. electron
- C. neutron
- D. the nucleus

12. Consider the following four elements: As, Se, Sb, and Te. Which of the four has the larger atomic radius?

- A. As
- B. Se
- C. Sb
- D. Te

| | |
|----|----|
| As | Se |
| Sb | Te |

- 2 -

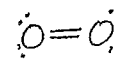
20. What is the name of the tin ion in SnSe₂?

- A. tin
- B. tin(II)
- C. tin(III)
- D. tin(IV)

Sn²⁺ Se²⁻ ? = 4 Roman numeral II

21. Which type of bond is formed between two atoms of oxygen in O₂?

- A. single bond
- B. double bond
- C. triple bond
- D. quadruple bond



22. What is the charge on the gold ion in Au₂S₃?

- A. 0
- B. 1+
- C. 2+
- D. 3+

Au³⁺ S²⁻ ? = 3

23. What is the formula for potassium phosphate?

- A. KPO
- B. K₂PO₃
- C. K₄PO
- D. K₃PO₄

K⁺ K⁺ K⁺ potassium ions
PO₄³⁻ phosphate ion

24. What is the formula for lead(IV) hypochlorite?

- A. Pb(IV)ClO
- B. Pb₄ClO
- C. PbClO₄
- D. Pb(ClO)₄

Pb⁴⁺
OCl⁻ OCl⁻ OCl⁻ OCl⁻

25. What is the name of SO₃?

- A. sulfur trioxide
- B. trisulfur monoxide
- C. sulfate
- D. sulfite

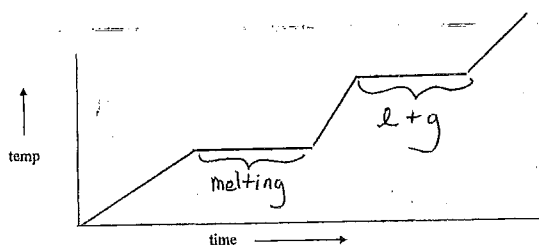
Prefix naming.

- 4 -

Written Response

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2. Explain, possibly with the use of a diagram, why a liquid will take on the shape of the container that it is in, but will not expand to fill the container. (2 marks)
 Particles in a liquid have enough energy to slide past each other but not separate. This means liquids can change shape but not volume. Gas particles have enough energy to separate, allowing gases to expand.
3. Paper chromatography is a physical separation technique that can be used to separate the several colours that are present in brown ink. How does paper chromatography accomplish this separation? (2 marks)

Chromatography relies on differences in absorption. Different colours that make up the brown ink move up the paper at different rates. **5**

4. How do the elements iodine and xenon differ in terms of reactivity, state, and ionization energy? (3 marks)

reactivity: I is more reactive than Xe
 state: I is a solid. Xe is a gas.
 IE: I has a lower ionization energy than Xe.

5. State the Periodic Law. (2 marks)

When the elements are listed in increasing order by atomic number there is a periodic appearance and reappearance of elements with similar properties.

6. Boron has two important isotopes: boron-11, and boron-12. Explain how they are similar and how they are different by making reference to their atomic structure. (2 marks)

Both have the same number of protons (5)
¹¹B has 6n and ¹²B has 7n.

7. Use the following data provided to find the atomic mass of the element magnesium to three decimal places. Show your calculation. Do not round until the end. (2 marks)

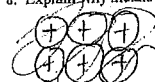
| | Mass of Atom | Abundance in Nature |
|-------------|--------------|---------------------|
| chlorine-35 | 34.9689 amu | 75.77 % |
| chlorine-37 | 36.9659 amu | 24.27 % |

$$34.9689 \times 0.7577 = 26.4959$$

$$36.9659 \times 0.2427 = 8.9716$$

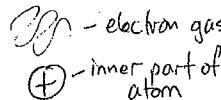
$$35.468 \text{ a.m.u.}$$

8. Explain why metals are ductile by making reference to the metallic bond. (2 marks)



can be drawn into wires

The metallic bond is strong but non-directional since the electron gas can move and hold the atoms together during deformation into wires.



- 6 -

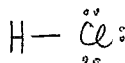
11. Complete the following tables. (13 marks)

| Formula | Name |
|--------------------------------------|------------------------------|
| FeCl ₂ | iron(II) chloride |
| Al(NO ₃) ₃ | aluminum nitrate |
| MnCl ₂ | manganese(II) chloride |
| KHCO ₃ | potassium hydrogen carbonate |
| P ₂ S ₄ | diphosphorus tetrasulfide |
| Au(CH ₃ COO) ₃ | gold(III) acetate |
| NH ₃ | ammonia |

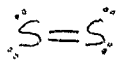
| Name | Formula |
|--------------------------------|--|
| dinitrogen monoxide | N ₂ O |
| calcium chloride penta hydrate | CaCl ₂ · 5H ₂ O |
| argon trioxide | ArO ₃ |
| calcium hydrogen sulphite | Ca(HSO ₃) ₂ |
| sodium dichromate | Na ₂ Cr ₂ O ₇ |
| water | H ₂ O |

10. Draw Lewis (electron dot) structures for the following: (7 marks)

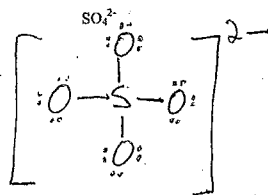
HCl



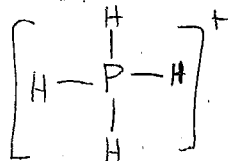
S₂



SO₄²⁻



PH₄⁺



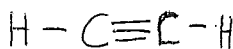
CN⁻



OCl₂



C₂H₂



The End !!!