



دائرة التعليم والمعرفة  
DEPARTMENT OF EDUCATION  
AND KNOWLEDGE

*Department of Education and Knowledge  
AlGhazali school for boys  
The Science department- Grade 9*

## **FINAL REVISION PAPERS**

**Includes**  
**separate sections questions,**  
**chapter revision**  
**and chapter Test**

Dear parents: It's our pleasure to put these revision papers between your hands as a tool for assessing your son knowledge and skills in science, and as a hint of what to expect in the final test, but it is important to know that the final test is prepared by MOE and this revision booklet is not in any way a replacement of the Text Book. Your son needs to revise the Textbook carefully then use the revision papers to test his understanding.

*Best regards.*

*Grade 9 Science teachers*

**Chapter 1: Introduction to Chemistry**

**Chapter 2: Analysing Data**

**Chapter 4: The Structure of the Atom**

**Chapter 5: Electrons in Atoms**

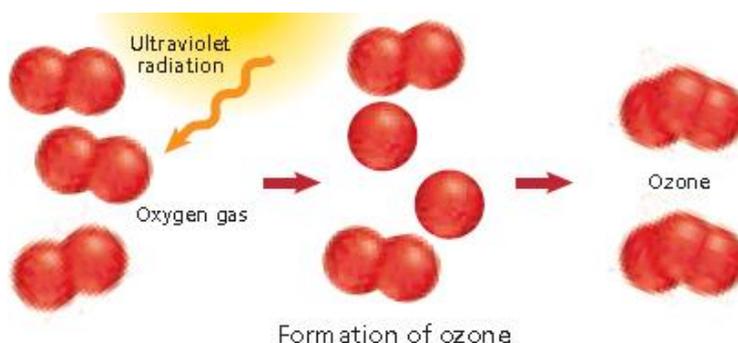


# **Introduction to Chemistry**

## **Chapter 1 Revision**

### **1.1 The Story of two Substances**

1- What would you expect to result from a decrease in the amount of ozone in the stratosphere?



- A) decrease in the amount of oxygen in the troposphere
- B) decrease in the number of individual oxygen particles
- C) increase in the amount of oxygen in the troposphere
- D) increase in the number of individual oxygen particles

2- Ozone is found in the \_\_\_\_.

- A) troposphere
- B) stratosphere
- C) mesosphere
- D) ionosphere

3- A chlorofluorocarbon is a chemical that is made of \_\_\_\_.

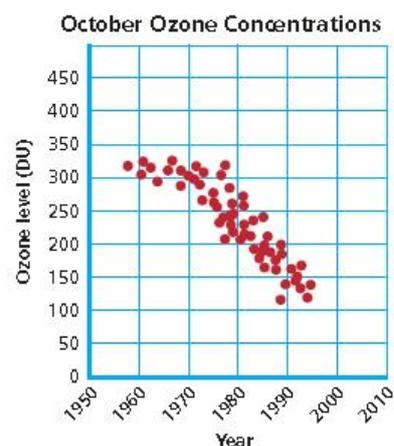
- A) chloron, fluoron, and carbon
- B) carbon and oxygen
- C) chlorine, fluorine, and carbon
- D) carbon and hydrogen

4- Look at the graph. During what year did the increase in CFC-11 concentration begin to level out?

- A) 1989
- B) 1991
- C) 1990
- D) 1984

5- Why were chlorofluorocarbons first developed?

- A) to destroy the ozone layer
- B) for use in plastic foam
- C) for use as spray can propellants
- D) to replace toxic gases in refrigerators



In your textbook, read about the ozone layer.

Use each of the terms below just once to complete the passage.

Atmosphere	oxygen gas	ozone	ozone hole	stratosphere
	troposphere		ultraviolet radiation	

Earth's (6) \_\_\_\_\_ is made up of several layers. The air we breathe makes up the lowest level. This layer is called the (7) \_\_\_\_\_. The next layer up is called the (8) \_\_\_\_\_. This level contains a protective (9) \_\_\_\_\_ layer. Ozone forms when (10) \_\_\_\_\_ is struck by ultraviolet radiation in the upper part of the stratosphere. The ozone forms a layer around Earth, which absorbs (11) \_\_\_\_\_. Without ozone, you are more likely to get a sunburn or possibly skin cancer. The thinning of the ozone layer, called the (12) \_\_\_\_\_ is worrisome because without ozone all organisms on Earth are subject to harm from too much radiation.

In your textbook, read about chlorofluorocarbons.

For each statement below, write true or false.

- \_\_\_\_\_ 13- CFC is another name for a chlorofluorocarbon.  
\_\_\_\_\_ 14- CFCs are made up of carbon, fluorine, and cesium.  
\_\_\_\_\_ 15- All CFCs are synthetic chemicals.  
\_\_\_\_\_ 16- CFCs usually react readily with other chemicals.  
\_\_\_\_\_ 17- CFCs were developed as replacements for toxic refrigerants.

## 1.2 Chemistry and Matter

18- Which of the following releases matter?

- A) engaging a car exhaust system
- B) picking up iron filings with a magnet
- C) turbines spinning in a power plant
- D) turning on an electric hot plate

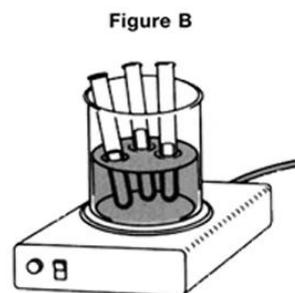
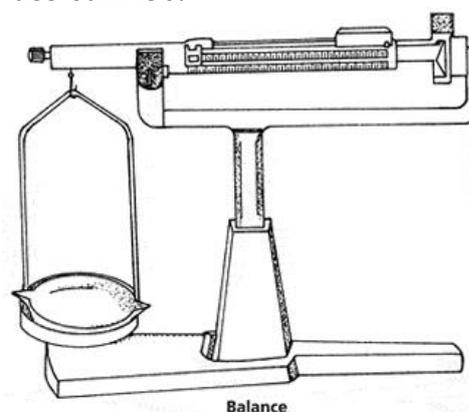


Figure C

19- Why can an object's weight vary with location but its mass cannot?

- A) Determinations of mass account for varying gravitational pulls in different locations.
- B) Mass is a measure of the amount of matter in an object; weight is not.
- C) Systems of measurement vary with location.
- D) Weight is a measure of both mass and the effect of Earth's gravitational pull on the matter. Mass measures only the amount of matter.



20- Anything that has mass and takes up space is \_\_\_\_\_

- A) matter
- B) volume
- C) pressure
- D) weight

21- Chemists whose specialty is determining the composition of chemicals work in the field of \_\_\_\_\_.

- A) analytical chemistry
- B) organic chemistry
- C) physical chemistry
- D) inorganic chemistry

22- What branch of chemistry is most concerned with the study of carbon compounds?

- A) analytical chemistry                      B) inorganic chemistry  
C) organic chemistry                         D) physical chemistry

In your textbook, read about chemistry and matter. Define each term.

23- Chemistry \_\_\_\_\_

24- matter \_\_\_\_\_

25- mass \_\_\_\_\_

Write each term below under the correct heading. Use each term only once.

Air	magnetic field	car	feeling	heat	human body	light
	radio	radio wave	flashlight	textbook	thought	

**Made of Matter**

**Not Made of Matter**

26- \_\_\_\_\_

27- \_\_\_\_\_

28- \_\_\_\_\_

29- \_\_\_\_\_

30- \_\_\_\_\_

31- \_\_\_\_\_

32- \_\_\_\_\_

33- \_\_\_\_\_

34- \_\_\_\_\_

35- \_\_\_\_\_

36- \_\_\_\_\_

37- \_\_\_\_\_

For each statement below, write true or false.

\_\_\_ 38- The mass of an object can vary with the object's location.

\_\_\_ 39- A mass measurement includes the effect of Earth's gravitational pull on the object being measured.

\_\_\_ 40- Scientists measure the amount of matter in terms of mass.

\_\_\_ 41- Subtle differences in weight exist at different locations on Earth.

\_\_\_ 42- Molina and Rowland concluded that (chlorine, radiation) formed by the breakdown of CFCs in the stratosphere reacts with ozone and destroys it.

Identify each branch of chemistry described.

43- The study of the matter and processes of living things \_\_\_\_\_

44- The study of carbon-containing chemicals \_\_\_\_\_

45- The study of the components and composition of substances \_\_\_\_\_

46- The study of matter that does not contain organic chemicals \_\_\_\_\_

47- The study of the behaviour and changes of matter and the related energy changes \_\_\_\_\_

For each branch of chemistry in Column A, write the letter of the item in Column B that pertains to that branch.

**Column A**

**Column B**

\_\_\_ 48- Organic chemistry

a- reaction mechanisms

\_\_\_ 49- Physical chemistry

b- minerals

\_\_\_ 50- Biochemistry

c- plastics

\_\_\_ 51- Analytical chemistry

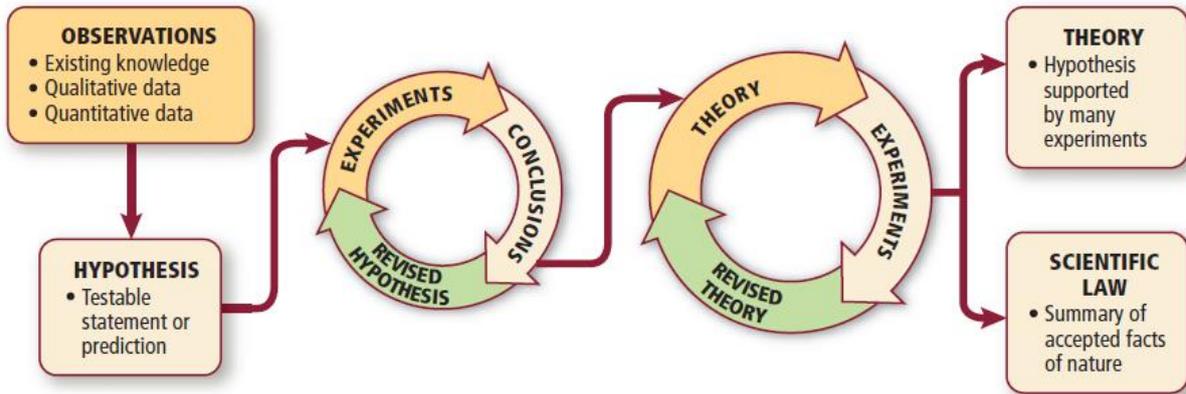
d- metabolism

\_\_\_ 52- Inorganic chemistry

e- quality control

# 1.3 Light and Quantized Energy

53- The general term for a systematic approach used in scientific study is \_\_\_\_.



- A) the scientific method      B) qualitative analysis  
C) quantitative analysis      D) the scientific controversy

54- The type of data that is descriptive in nature is \_\_\_\_\_.

- A) quantitative data      B) qualitative data  
C) random data      D) hypothetical data

55- The variable that you plan to change during the course of an experiment is \_\_\_\_\_.

- A) the independent variable      B) the dependent variable  
C) a constant      D) a control

56- When an explanation has been supported by many experiments, the explanation is a \_\_\_\_.

- A) hypothesis      B) theory  
C) law      D) model

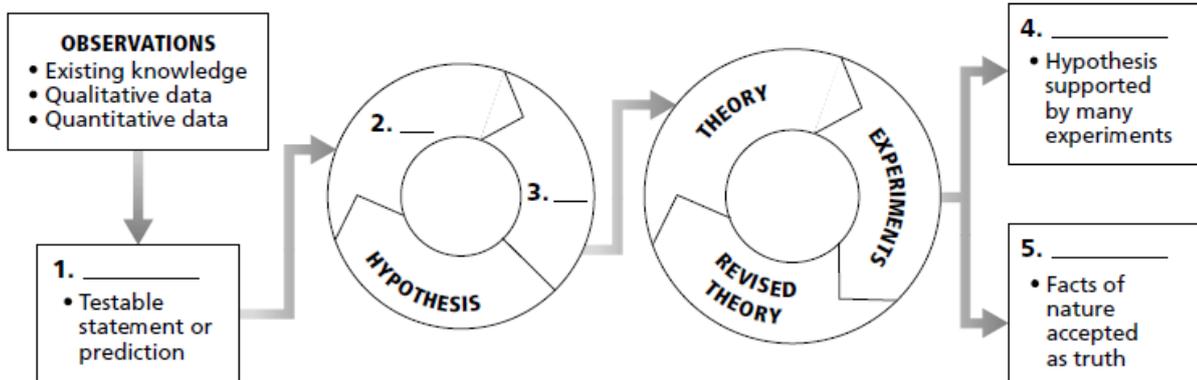
57- A tentative explanation for a series of observations is a \_\_\_\_\_.

- A) hypothesis      B) theory  
C) law      D) model

In your textbook, read about a systematic approach that scientists use.

Use the words below to complete the concept map. Write your answers in the spaces below the concept map.

Conclusions      experiments      hypothesis      scientific law      theory



58- \_\_\_\_\_      59- \_\_\_\_\_      60- \_\_\_\_\_  
61- \_\_\_\_\_      62- \_\_\_\_\_

For each item in Column A, write the letter of the matching item in Column B.

Column A	Column B
___ 63- Refers to physical characteristics such as color, odor, or shape	a-observation
___ 64- Refers to mass, volume, and temperature measurements	b-qualitative data
___ 65- A variable controlled by the experimenter	c-quantitative data
___ 66- The act of gathering information	d-independent variable
___ 67- Changes in value based on the value of the controlled variable	e-dependent variable

**Circle the letter of the choice that best completes the statement.**

68- A constant is a factor that

- A) changes during an experiment.
- B) changes from one lab group to another.
- C) is affected by the dependent variable.
- D) is not allowed to change during an experiment.

69- A control is a

- A) variable that changes during an experiment.
- B) standard for comparison.
- C) type of dependent variable.
- D) type of experiment.

70- A hypothesis is a(n)

- A) set of controlled observations.
- B) explanation supported by many experiments.
- C) tentative explanation of observations.
- D) law describing a relationship in nature.

71- A theory is a(n)

- A) set of controlled observations.
- B) explanation supported by many experiments.
- C) tentative explanation of observations.
- D) law describing a relationship in nature.

72- A model is a(n)

- A) visual, verbal, and/or mathematical explanation of how things occur.
- B) explanation that is supported by many experiments.
- C) description of a relationship in nature.
- D) tentative explanation about what has been observed.

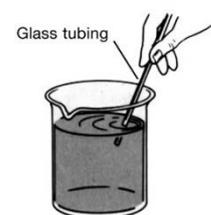
In the space at the left, write the word or phrase in parentheses that correctly completes the statement.

- \_\_\_\_\_ 73- Molina and Rowland used a (model, scientific method) to learn about CFCs in the atmosphere.
- \_\_\_\_\_ 74- Their hypothesis was that CFCs break down in the stratosphere due to interactions with (ultraviolet light, oxygen).
- \_\_\_\_\_ 75- Molina and Rowland thought that these interactions produced a chemical that could break down (chlorine, ozone).
- \_\_\_\_\_ 76- To test their (data, hypothesis), Molina and Rowland examined interactions that occur in the stratosphere.
- \_\_\_\_\_ 77- Based on their data, Molina and Rowland developed a (hypothesis, model) that explained how CFCs destroy ozone.
- \_\_\_\_\_ 78- Molina and Rowland concluded that (chlorine, radiation) formed by the breakdown of CFCs in the stratosphere reacts with ozone and destroys it.

## 1.4 Scientific Research

79- Which of the following materials was discovered by chance during research on artificial fiber creation?

- A) lysozyme      B) nylon      C) ozone      D) silk



80- Two items that must be worn during any laboratory experiment are \_\_\_\_\_.

- A) safety goggles and a lab apron      B) safety goggles and fire-proof mitts  
C) gloves and a lab apron      D) rubber gloves and a face shield

81- When a laboratory session ends, you must always \_\_\_\_\_.

- A) wash your hands      B) wash your eyes in the eye-wash fountain  
C) eat or drink in the laboratory      D) take a shower in the chemical hazard shower

82- Research that is conducted for the sake of increasing fundamental knowledge is \_\_\_\_\_.

- A) technology      B) applied research  
C) pure research      D) theoretical research

83- Research on solubility as a factor that affects the digestion of foods in humans would be an example of \_\_\_\_\_.

- A) technology      B) fundamental research  
C) applied research      D) theoretical research

In your textbook, read about types of scientific investigations.

For each description below, write A for applied research or P for pure research.

- \_\_\_\_\_ 84- Is undertaken to solve a specific problem
- \_\_\_\_\_ 85- Seeks to gain knowledge for the sake of knowledge itself
- \_\_\_\_\_ 86- Is used to find CFC replacements
- \_\_\_\_\_ 87- Was conducted by Molina and Rowland

In your textbook, read about students in the laboratory and the benefits of chemistry. Answer the following questions.

88- When should you read the label on a chemical container?

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89- What do scientists usually do when a scientific problem first arises?

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90- What kinds of clothing should not be worn in the lab?

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91- What is technology?

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## Standardized Test Practice

92- What is the radiation blocked by ozone?

- A) infrared      B) microwave      C) ultraviolet      D) alpha

93- What is the unit used to measure ozone in the atmosphere?

- A) dobson units      B) pascals      C) kilometers      D) degrees Celsius

94- Look at the graph. In what year did global CFC consumption drop most dramatically?

- A) 1986      B) 1989      C) 1991      D) 1996

95- What is the measurement of matter whose value depends on the force of gravity?

- A) mass      B) volume      C) energy      D) weight

96- Chemists who study the chemistry of living organisms work in the field of \_\_\_\_\_.

- A) analytical chemistry      B) physical chemistry  
C) organic chemistry      D) biochemistry

97- A branch of chemistry that is concerned with how and why chemicals interact is \_\_\_\_.

- A) analytical chemistry      B) biochemistry  
C) theoretical chemistry      D) physical chemistry

98- In the model shown above, what event first releases chlorine?

- A) ultraviolet radiation strikes a CFC ( $\text{CCl}_3\text{F}$ )  
B) ultraviolet radiation strikes ozone ( $\text{O}_3$ )  
C) Oxygen (O) combines with chlorine monoxide (ClO)  
D) Chlorine (Cl) combines with ozone ( $\text{O}_3$ )

99- What is the name given to a set of controlled observations that test a proposed explanation?

- A) hypothesis      B) experiment      C) theory      D) conclusion

100- A judgment based upon the results of an experiment is a \_\_\_\_\_.

- A) hypothesis      B) theory      C) variable      D) conclusion

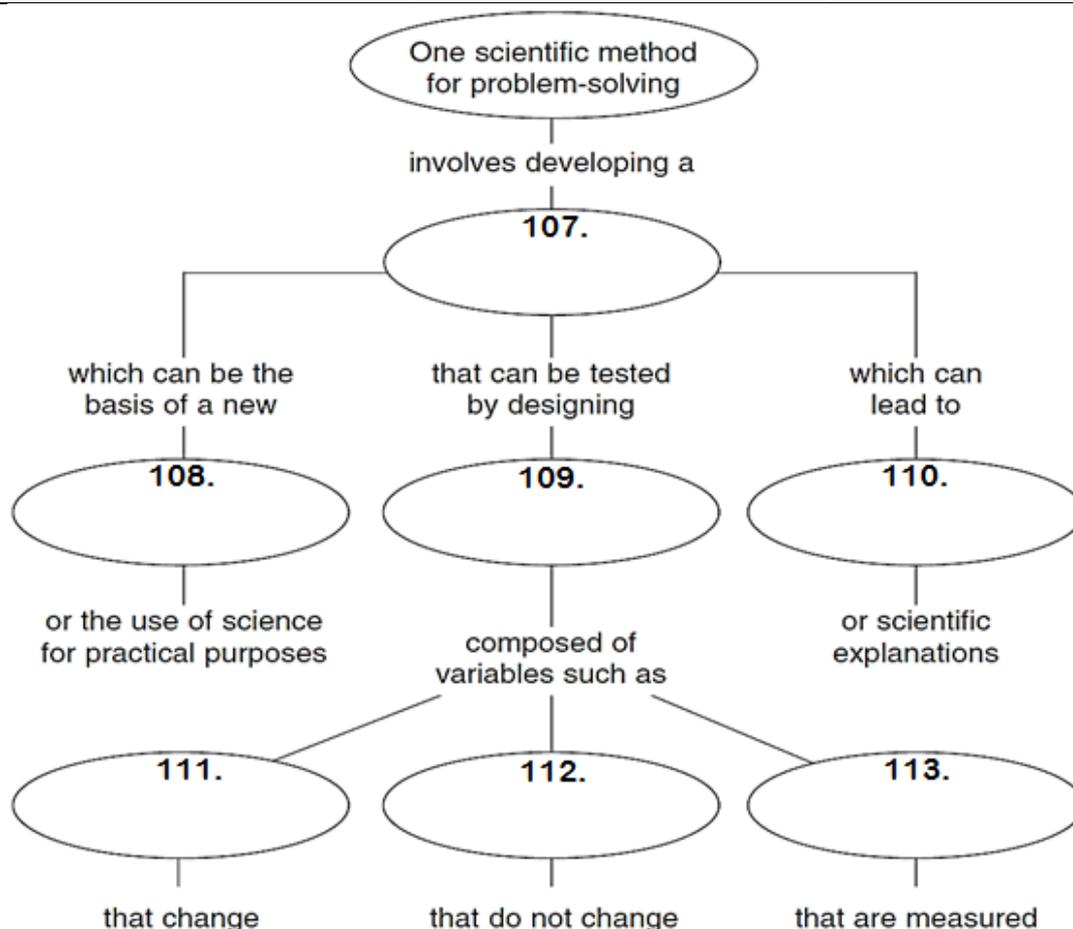
101- A \_\_\_\_\_ can be used to help visualize microscopic structures and events.

- A) variable      B) hypothesis      C) theory      D) model

- 102-** Suppose that you experimentally determine the mass of nylon formed as a result of each of several similar chemical processes. What are the measurements of mass called?  
**A)** qualitative data                      **B)** independent variables  
**C)** controls                                  **D)** quantitative data
- 103-** What is the name given to research that is undertaken to solve a specific problem?  
**A)** pure research                          **B)** theoretical research  
**C)** applied research                      **D)** technology
- 104-** The study of Earth's atmospheric ozone and the effect of chlorofluorocarbons on ozone is an example of \_\_\_\_\_.  
**A)** technology                              **B)** applied research  
**C)** basic research                         **D)** theoretical research
- 105-** In the laboratory, one should NEVER \_\_\_\_\_.  
**A)** ask questions  
**B)** know how to contact help  
**C)** wear safety goggles and a lab apron  
**D)** perform experiments without your teacher's permission.
- 106-** Almost every situation you can imagine involves a chemist, because \_\_\_\_\_.  
**A)** chemists are nosy                      **B)** everything is made of matter  
**C)** chemists are well-paid                **D)** ozone depletion is a problem

**Complete the concept map by using the words below.**

scientific theories	constants	technology	hypothesis
dependent variables	experiments		independent variables



**Write the correct term in the spaces beside each definition.**

**114-** a prediction or statement that can be tested \_\_\_\_\_

**115-** use of knowledge to make products or tools \_\_\_\_\_

**116-** a factor in an experiment that can change \_\_\_\_\_

**117-** a standard to which experimental results can be compared \_\_\_\_\_

**118-** variable being measured \_\_\_\_\_

**119-** variable that changes \_\_\_\_\_

**120-** problem-solving by following steps to draw a conclusion  
\_\_\_\_\_

**121-** a process of observing, studying, and thinking about things to gain  
knowledge \_\_\_\_\_

**122-** personal opinion that may affect experiments \_\_\_\_\_.

**Number these steps for doing an experiment in the correct order in the blanks provided.**

\_\_\_\_\_ **123-** Draw conclusions.

\_\_\_\_\_ **124-** Form a hypothesis.

\_\_\_\_\_ **125-** Gather information (research).

\_\_\_\_\_ **126** Test your hypothesis.

\_\_\_\_\_ **127-** Recognize the problem.

\_\_\_\_\_ **128-** Analyze your data.

**Correctly complete each sentence by underlining the best of the three choices in parentheses.**

**129-** Scientists use (observations, experiments, observations and experiments) to find answers to problems.

**130-** The variables that do not change in an experiment are called (dependent, independent, constants).

**131-** An instrument used to measure air pressure is a (thermometer, barometer, hygrometer).

**132-** Scientific (theories, hypotheses, laws) describe what will happen, but do not explain why.

**133-** (Ethics, Science, Mathematics) deals with moral values about what is good or bad.

Name: .....

9\ .....

**Q1: For each statement below, write (T) for true or (F) for false.**

- \_\_\_ 1- CFC is another name for a chlorofluorocarbon.
- \_\_\_ 2- The mass of an object can vary with the object's location.
- \_\_\_ 3- Ozone is formed above the equator and move with air currents.
- \_\_\_ 4- The part of UV light responsible for the formation of Ozone is UVA.
- \_\_\_ 5- The dependent variable is affected by the changes in the independent variable.
- \_\_\_ 6- CFCs are synthetic chemicals developed to replace toxic refrigerants
- \_\_\_ 7- Macroscopic characteristics cannot be observed by our senses.
- \_\_\_ 8- Ozone can be found in the lower parts of the stratosphere.
- \_\_\_ 9- some differences in weight exist at different locations on Earth.
- \_\_\_ 10-UVB type is very harmful for living organisms.

**Q2: For each branch of chemistry in Column A, write the letter of the item in Column B that pertains to that branch.**

Column A

- \_\_\_ 1- Organic chemistry
- \_\_\_ 2- Physical chemistry
- \_\_\_ 3- Thermochemistry
- \_\_\_ 4- Industrial chemistry
- \_\_\_ 5- Inorganic chemistry

Column B

- a- reaction rates
- b- Metals and non-metals
- c- Pharmaceuticals
- d- Heat
- e- Paints and coating

**Q3: In the space at the left, write the word or phrase in parentheses that correctly completes the statement.**

- \_\_\_\_\_ 1- Molina and Rowland used a **(model, scientific method)** to learn about CFCs in the atmosphere.
- \_\_\_\_\_ 2- Their hypothesis was that CFCs break down in the stratosphere due to interactions with **(ultraviolet light, oxygen)**.
- \_\_\_\_\_ 3- Molina and Rowland thought that these interactions produced a chemical that could break down **(chlorine, ozone)**.
- \_\_\_\_\_ 4- To test their **(data, hypothesis)**, Molina and Rowland examined interactions that occur in the stratosphere.
- \_\_\_\_\_ 5- Based on their data, Molina and Rowland developed a **(hypothesis, model)** that explained how CFCs destroy ozone.

**Q4: For each item in Column A, write the letter of the matching item in Column B.**

**Column A**

**Column B**

- |           |  |                         |
|-----------|--|-------------------------|
| _____ 1-  | Changes in value based on the value of the controlled variable       | a- Observation          |
| _____ 2-  | standard for comparison.   | b- qualitative data     |
| _____ 3-  | Refers to physical characteristics such as colour, odour, or shape   | c- quantitative data    |
| _____ 4-  | visual, verbal, and/or mathematical explanation of how things occur. | d- independent variable |
| _____ 5-  | explanation supported by many experiments.                           | e- dependent variable   |
| _____ 6-  | tentative explanation of observations.                               | f- A constant           |
| _____ 7-  | A variable controlled by the experimenter                            | g- A control            |
| _____ 8-  | Refers to mass, volume, and temperature measurements                 | h- Hypothesis           |
| _____ 9-  | A variable that is not allowed to change during an experiment.       | i- Theory               |
| _____ 10- | The act of gathering information                                     | j- Model                |

**Q5:** You and a friend are making sweetened iced tea. You both have different opinions about how much sugar to add and at what temperature is best to add the sugar. Design an experiment to find out how much sugar will dissolve at three different temperatures. In your experiment, identify the following:

- a- Qualitative data: \_\_\_\_\_
- b- Quantitative data: \_\_\_\_\_
- c- Independent variable: \_\_\_\_\_
- d- Dependent variable: \_\_\_\_\_

**Q6: For each description below, write A for applied research or P for pure research.**

- \_\_\_\_\_ 1- Study the properties of black holes.
- \_\_\_\_\_ 2- Make a new vaccine for influenza.
- \_\_\_\_\_ 3- Looking for a new clean energy resource.
- \_\_\_\_\_ 4- Discover and study new species in the rainforests.
- \_\_\_\_\_ 5- Finding ways to increase food production.
- \_\_\_\_\_ 6- Explore new areas under the dead sea.

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**Good Luck** 😊😊😊



# Analysing Data

## Chapter 2 Revision

### 2.1 Measurements and Units

- A sample of Mercury has a mass of 14.9 g and a density of 13.6 g/cm<sup>3</sup> of. What is the volume of Mercury as a significant figure?  
A) 1.10 cm<sup>3</sup>      B) 1.0955 cm<sup>3</sup>      C) 14.9 cm<sup>3</sup>      D) 0.9 cm<sup>3</sup>
- In the SI system of measurement, there are seven \_\_\_\_\_ units  
A) metric      B) English      C) derived      D) base
- Which of the following physical properties is not paired with the correct SI base unit or measurement?  
A) length: meter      B) time: second      C) mass: gram      D) temperature: Kelvin
- What scale provides the base unit for temperature in the SI system?  
A) Celsius scale      B) Fahrenheit scale      C) Kelvin scale      D) Centigrade
- What is the temperature 51°C expressed in kelvins?  
A) 273.0 K      B) 222 K      C) 324 K      D) 324 K

In your textbook, read about SI units then complete the following table.

SI Base Units		
Quantity	Base unit	Unit abbreviation
6.		s
7. Mass		
8.	kelvin	
9. Length		

In your textbook, read about base units and derived units.

For each SI unit in Column A, write the letter of the matching item from Column B.

Column A

Column B

\_\_\_\_ 10- second

a- A platinum-iridium cylinder that is stored at constant temperature and humidity

\_\_\_\_ 11- meter

b- The microwave frequency given off by a cesium-133 atom

\_\_\_\_ 12- kilogram

c- A cube whose sides all measure exactly one meter

\_\_\_\_ 13- cubic meter

d- The distance that light travels through a vacuum in 1/299 792 458 second

14- Use Table 2–2 in your textbook to arrange the following prefixes in order from largest to smallest.

centi-      giga-      kilo-      mega-      milli-      nano-      pico-

Largest

Smallest

List the symbols and factors that the following prefixes represent.

15- centi- \_\_\_\_\_      16- kilo- \_\_\_\_\_      17- milli- \_\_\_\_\_

Answer the following questions.

18- Which temperature scale will you use for your experiments in this class? Is this an SI unit? \_\_\_\_\_

19- How many grams are in a kilogram? \_\_\_\_\_

20- How many liters are in a megaliter? \_\_\_\_\_

21- How many centimeters are in a meter? \_\_\_\_\_

22- What is the difference between a base unit and a derived unit?  
\_\_\_\_\_

23- What is density? \_\_\_\_\_

24- Explain in terms of density why a grocery bag containing all canned goods is harder to lift than a grocery bag containing all paper goods.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

25- How can you obtain an object's volume if you know its density and its mass?  
\_\_\_\_\_  
\_\_\_\_\_

26- What is the three-part process for problem solving?  
\_\_\_\_\_

27- How are degrees Celsius converted to kelvins?  
\_\_\_\_\_

## 2.2 Scientific Notation and Dimensional Analysis

28- Which of the following numbers is equal to  $5.80 \times 10^{-5}$ ?

A) 0.000058      B) 0.0675      C)  $58 \times 10^{-4}$       D) 5800

29- How many liters are there in 3.0 milliliter?

A)  $3.0 \times 10^{-1}$  L      B)  $3.0 \times 10^{-2}$  L      C)  $3.0 \times 10^{-3}$  L      D)  $3.0 \times 10^{-4}$  L

30- Dimensional analysis is a method of problem-solving that focuses on \_\_\_\_\_ .

- A) units      B) error      C) accuracy      D) precision

31- Use the conversion factor to find the kilometers in  $2.7 \times 10^3$  meters.

- A)  $2.7 \times 10^5$  km      B)  $2.7 \times 10^{-3}$  km      C) 2.7 km      D)  $2.7 \times 10^6$  km

1Km

1000m

In your textbook, read about scientific notation.

Circle the figures that are written in scientific notation.

32-  $1.61 \times 10^2$

33-  $1.61 \times 10 \times 10$

34-  $1.61 \times 100$

35- 161 km

36-  $1.62762 \times 10^{27}$  kg

37-  $9.10939 \times 10^{-31}$

38-  $2.8 \times 10^8$

39- 1 380 000

Change the following data into scientific notation.

40- 5 000 000 km \_\_\_\_\_

41- 8 394 000 000 s \_\_\_\_\_

42- 0.000 421 g \_\_\_\_\_

43- 0.03 cm \_\_\_\_\_

In your textbook, read about dimensional analysis.

Answer the following questions.

44- What is a conversion factor?

\_\_\_\_\_

45- What is dimensional analysis?

\_\_\_\_\_

Complete the following dimensional analysis problems.

46- Convert 50 kilograms into grams.

$$\frac{50 \text{ _____}}{\text{_____}} \times \frac{1000 \text{ _____}}{1 \text{ _____}} = 50\,000 \text{ _____}$$

47- Convert 5 meters into centimeters.

$$\frac{5 \text{ _____}}{\text{_____}} \times \frac{100 \text{ _____}}{1 \text{ _____}} = 500 \text{ _____}$$

48- Convert 5 liters into kiloliters.

$$\frac{5 \text{ _____}}{\text{_____}} \times \frac{1 \text{ _____}}{1000 \text{ _____}} = 0.005 \text{ _____}$$

49- Convert 5 centimeters into meters.

$$\frac{5 \text{ _____}}{\text{_____}} \times \frac{1 \text{ _____}}{100 \text{ _____}} = 0.05 \text{ _____}$$

50- Convert 55 kilometers per hour into meters per second. Use the conversion factor  
 $1 \text{ km} = 1000 \text{ m}$ .

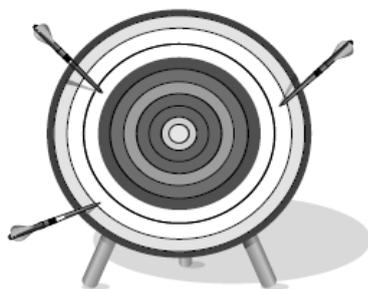
$$\frac{55 \text{ _____}}{1 \text{ _____}} \times \frac{1000 \text{ _____}}{1 \text{ _____}} \times \frac{1 \text{ _____}}{60 \text{ _____}} \times \frac{1 \text{ _____}}{60 \text{ _____}} = 15 \text{ _____}$$

## 2.3 Uncertainty in Measurements and Calculations

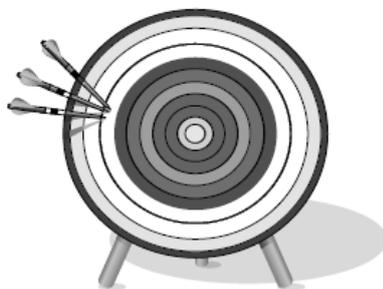
- 60- Why are plus and minus signs ignored in calculating percent error?  
A) Accepted values for data do not include negative numbers.  
B) An experimental value smaller than the accepted value is not considered an error.  
C) Only the size of the error matters, not whether the values in error are larger or smaller than the accepted values.  
D) The formula for percent error automatically cancels out the signs.
- 61- The sum of  $4.824 + 2.03 + 4.72319 + 123.4567 + 111.1$  expressed to the proper number of significant figures is .  
A) 246            B) 246.1            C) 246.13            D) 246.134
- 62- The closeness of experimental data readings to each other's \_\_\_\_\_.  
A) accuracy            B) precision            C) percent error            D) error
- 63- What is the error if a measured value is 24.59 g/mL and the accepted value is 25.49 g/mL?  
A) 1            B) -1            C) -0.9            D) 3.5%
- 64- How many significant figures will there be when the density value is calculated from the following data? mass = 15.47g; volume =5.2 mL  
A) 2            B) 3            C) 4            D) 5

In your textbook, read about accuracy and precision.

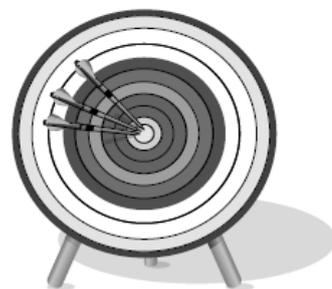
Use the terms precise and accurate to describe the following figures. You may use both terms for some figures. If a term does not apply to a figure, leave the space blank.



65- \_\_\_\_\_  
\_\_\_\_\_



66- \_\_\_\_\_  
\_\_\_\_\_



67- \_\_\_\_\_  
\_\_\_\_\_

Circle the letter of the choice that best completes the statement or answers the question.

- 67- The difference between an accepted value and an experimental value is called a(n) \_\_\_\_\_.  
A) error.            B) percent error.  
C) measured value.            D) precise measurement.
- 68- The ratio of an error to an accepted value is called a(n) \_\_\_\_\_.  
A) accuracy-to-precision value.            B) accuracy.  
C) percent error.            D) precision.



Complete the following calculations. Round off the answers to the correct number of significant figures.

91-  $51.2 \text{ kg} + 64.44 \text{ kg}$  \_\_\_\_\_

92-  $6.435 \text{ cm} - 2.18 \text{ cm}$  \_\_\_\_\_

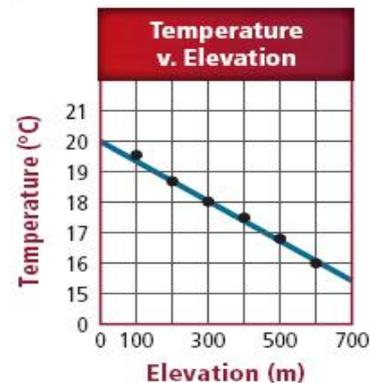
93-  $16 \text{ m} \times 2.82 \text{ m} \times 0.05 \text{ m}$  \_\_\_\_\_

94-  $3.46 \text{ m} \div 1.82 \text{ s}$  \_\_\_\_\_

## 2.1 Representing Data

95- What is the slope of the linear graph?

- A) slope =  $-6.67 \times 10^{-3} \text{ }^\circ\text{C/m}$
- B) slope =  $150 \text{ m/}^\circ\text{C}$
- C) slope =  $-8 \times 10^{-3} \text{ }^\circ\text{C/m}$
- D) slope =  $200 \text{ m/}^\circ\text{C}$

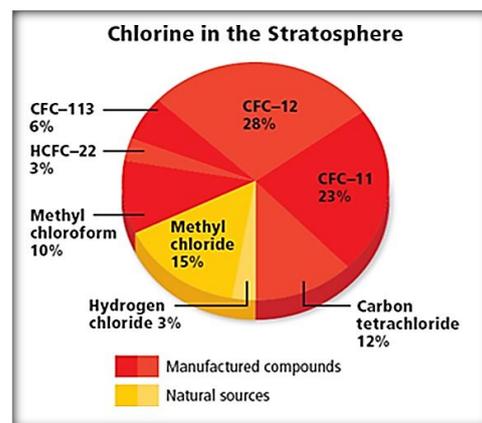


96- The representation of data on graph that resembles a pizza is a \_\_\_\_\_.

- A) circle graph
- B) bar graph
- C) line graph
- D) inverse

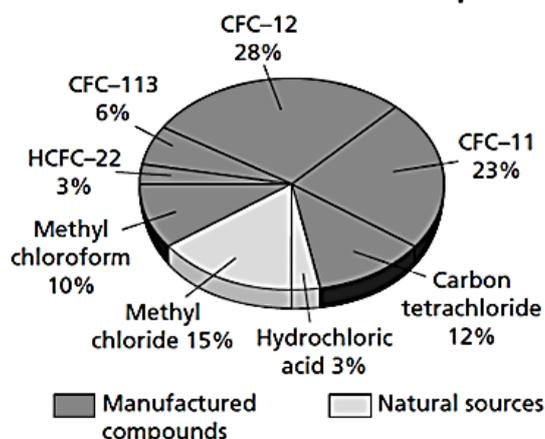
97- Look at graph “chlorine in the atmosphere”. Which substance is responsible for most of the chlorine in the stratosphere?

- A) Methyl chloride
- B) HCFC-22
- C) Carbon tetrachloride chloroform
- D) CFC-12

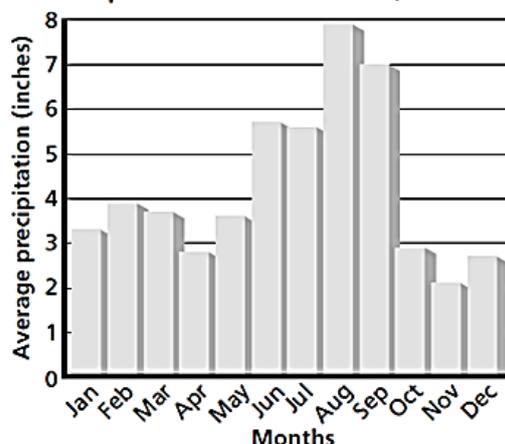


In your textbook, read about graphing. Label each kind of graph shown.

A. Sources of Chlorine in the Stratosphere



B. Precipitation in Jacksonville (1961–1990)



98- \_\_\_\_\_

99- \_\_\_\_\_

Answer the following questions about the graphs.

100- What percent of the sources of chlorine in the stratosphere are CFCs? \_\_\_\_\_

101- During which month of the year does Jacksonville usually get the most precipitation? \_\_\_\_\_ The least? \_\_\_\_\_

In your textbook, read about line graphs.

Sequence the following steps. Write 1 beside the first step in plotting a line graph. Write 2 beside the second step, and so on.

- \_\_\_\_\_ 103- Give the graph a title.  
\_\_\_\_\_ 104- Choose the ranges for the axes.  
\_\_\_\_\_ 105- Identify the independent and dependent variables.  
\_\_\_\_\_ 106- Plot the data points.  
\_\_\_\_\_ 107- Determine the range of the data that needs to be plotted for each axis.  
\_\_\_\_\_ 108- Draw the “best fit” line for the data.  
\_\_\_\_\_ 109- Number and label each axis.

## Chapter Test Practice

110- Look at the graph “chlorine in the atmosphere” above. Which two substances has the least contribution to chlorine in the stratosphere?

- A) CFC-12 and Methyl chloride                      B) HCFC-22 and CFC-11  
C) Hydrogen chloride and HCFC-22                D) CFC-12 and CFC-11

111- What is the temperature 51°C expressed in Fahrenheit?

- A) 123.8 °F                      B) 149.4 °F                      C) 10.56 °F                      D) -3.67 °F

112- Use the conversion factor to find the meters in  $2.7 \times 10^3$  kilometers.

- A)  $2.7 \times 10^5$  m                      B)  $2.7 \times 10^{-3}$  m  
C) 2.7 m                              D)  $2.7 \times 10^6$  m
- $\frac{1000m}{1km}$

113- Which of the following conversion factors would be most useful in converting miles per gallon to kilometers per gallon?

- A) 1 gallon/4 quarts    B) 1 liter/1000 ml    C) 0.62 km /1 mile    D) 1 000 m/1 km

114- Which of the following numbers is equal to  $2.70 \times 10^{-4}$ ?

- A) 0.00027                      B) 0.675                      C)  $27 \times 10^{-3}$                       D) 270

115- The closeness of an experimental value to an accepted value is its \_\_\_\_\_.

- A) accuracy                      B) precision                      C) percent error                      D) error

116- How many significant figures will there be when the density value is calculated from the following data? mass = 24.47g; volume =13.2 mL

- A) 2                                  B) 3                                  C) 4                                  D) 5

117- In the SI system of measurement, Units that are expressed by a combination of other units are called \_\_\_\_ units

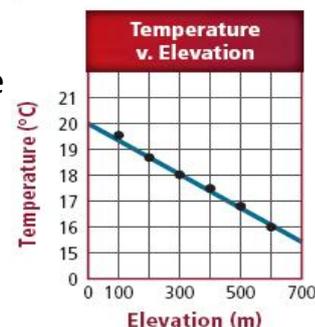
- A) metric                              B) English                              C) derived                              D) base

118- How is the slope of a linear graph calculated?

- A) slope =  $(y_2 - y_1) \times 100$                       B) slope =  $(x_2 - x_1) / 100$   
C) slope =  $(x_2 - x_1) / (y_2 - y_1)$                 D) slope =  $(y_2 - y_1) / (x_2 - x_1)$

119- Look at the graph. Which elevation has the temperature of 16°C?

- A) 200 m                              B) 600 m                              C) 550 m                              D) 400 m



# Standardized Test Practice

120- Below is a list of common prefixes used in the SI and metric systems.

Included with each is an abbreviation and a definition. Which set contains an error?

	Prefix	abbreviation	definition
A)	mega	m	$10^6$
B)	deci	d	$10^{-1}$
C)	centi	c	$10^{-2}$
D)	micro	$\mu$	$10^{-6}$

121- A unit that is defined by a combination of base units is a(n) \_\_\_\_\_.

- A) metric unit                      B) English unit                      C) SI unit                      D) derived unit

122- What volume is occupied by 16.4 g of mercury? The density of mercury is 13.6 g/mL.

- A) 1.21 mL                      B) 0.829 mL                      C) 223 mL                      D) 30.0 mL

123- Which of the following lists units in increasing order by volume?

- A) microliter < kiloliter < centiliter < liter < milliliter  
 B) milliliter < centiliter < microliter < kiloliter < liter  
 C) centiliter < milliliter < liter < kiloliter < microliter  
 D) microliter < milliliter < centiliter < liter < kiloliter

124- What is the area in square millimeters of a rectangle that is 7.431 cm long and 23.33 mm wide?

- A) 1734 mm<sup>2</sup>                      B) 173.4 mm<sup>2</sup>                      C) 17.34 mm<sup>2</sup>                      D) 1.734mm<sup>2</sup>

125- Convert 299,000,000 to scientific notation.

- A)  $2.99 \times 10^6$                       B)  $2.99 \times 10^{-5}$                       C)  $2.99 \times 10^8$                       D)  $2.99 \times 10^{-9}$

126- If each 1000 grams of water contains 9.0 grams of salt, find the grams of salt in 30 grams of water.

- A) 2.7 grams                      B)  $2.7 \times 10^1$  grams                      C)  $2.7 \times 10^{-1}$  grams                      D)  $2.7 \times 10^{-2}$  grams

127- Which of the following numbers has 4 significant figures?

- A) 0.05208                      B) 0.052                      C) 0.0521                      D) 0.0.52089

128- Perform the indicated mathematical operations and report the answer to the proper number of significant figures.  $(21.55 \times 4.12) / 42.42$

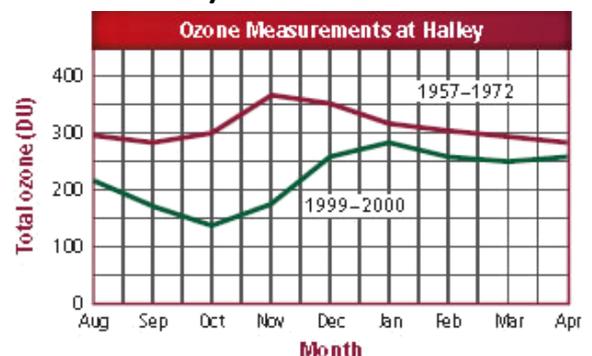
- A) 2.1                      B) 2.09                      C) 2.093                      D) 2.093 0

129- A measure of the closeness of a series of measurements is their \_\_\_\_.

- A) accuracy                      B) precision                      C) percent error                      D) error

130- In the graph, how much did ozone levels vary in the 9-month period shown for 1957-1972?

- A) around 80 DU  
 B) around 200 DU  
 C) around 10 DU  
 D) around 350 DU



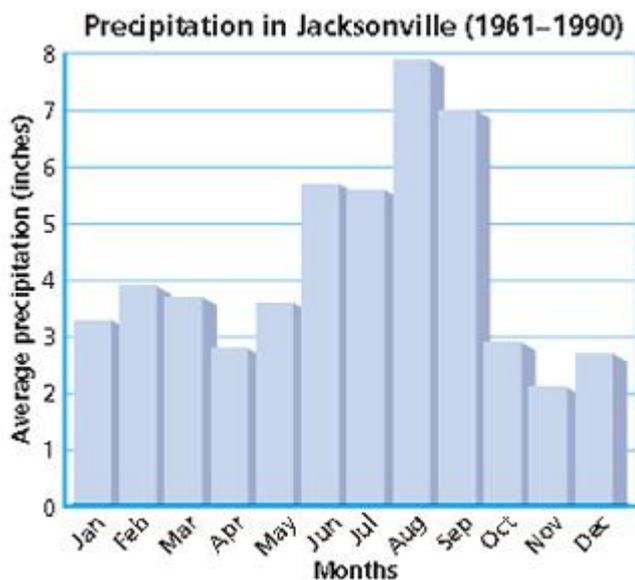
131- Which of the following is not a significant figure?

- A) a value of 1 through 9
- B) a zero between two digits that have values of 1 through 9
- C) zeros to the right of a significant digit when a decimal point is present
- D) zeros to the left of the first significant digit

132- Water has a density of  $1\text{g/cm}^3$ . What is the mass of 81 mL?

- A) 90 grams
- B) 81 grams
- C) 50 kilograms
- D) 0.012 grams

133-



From the graph above, how many months show an average precipitation of less than 4 inches?

- A) 6
- B) 8
- C) 9
- D) 7

134- How could one use this graph to find the average annual precipitation in Jacksonville?

- A) This information cannot be found from the graph.
- B) Find the total precipitation and divide by the number of months shown.
- C) Find the height of the middle month and multiply by 12.
- D) Add together the average precipitation figures from each month.

Name: .....

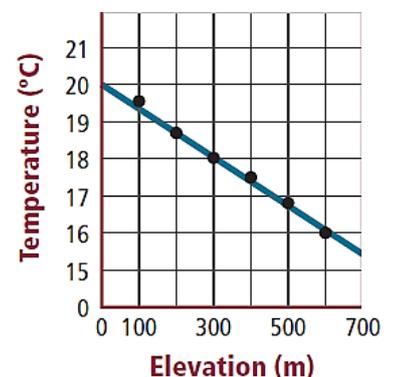
9\ .....

**Circle the correct answer:**

- 1- The closeness of an experimental value to an accepted value is its \_\_\_\_\_.  
A. accuracy      B. precision      C. percent error      D. error
- 2- How is the slope of a linear graph calculated?  
A. slope =  $(y_2 - y_1) \times 100$       B. slope =  $(x_2 - x_1) / 100$   
C. slope =  $(x_2 - x_1) / (y_2 - y_1)$       D. slope =  $(y_2 - y_1) / (x_2 - x_1)$
- 3- Below is a list of common prefixes used in the SI and metric systems. Included with each is an abbreviation and a definition. Which set contains an error?

	Prefix	abbreviation	definition
A.	mega	M	$10^6$
B.	deci	d	$10^{-1}$
C.	centi	c	$10^{-2}$
D.	micro	$\mu$	$10^{-12}$

- 4- A unit that is defined by a combination of base units is a(n) \_\_\_\_\_.  
A. metric unit      B. English unit      C. SI unit      D. derived unit
- 5- A measure of the closeness of a series of measurements is their \_\_\_\_\_.  
A. accuracy      B. precision      C. percent error      D. error
- 6- Which of the following is not a significant figure?  
A. a value of 1 through 9  
B. a zero between two digits that have values of 1 through 9  
C. zeros to the right of a significant digit when a decimal point is present  
D. zeros to the left of the first significant digit
- 7- In the SI system of measurement, there are seven \_\_\_\_\_ units  
A. metric      B. English      C. derived      D. base
- 8- The error expressed as a percentage of the accepted value is called:  
A. Error      B. Random error      C. Percent error      D. Systematic error
- 9- A graph that represent data using columns of different heights is called:  
A. Pie Chart      B. Bar graph  
C. Circle graph      D. Line graph
- 10- What is the relationship between elevation and temperature?  
A. linear, positive slope  
B. linear, negative slope  
C. linear, slope = 0  
D. nonlinear, negative slope



11- An object with a mass of 7.5 g raises the level of water in a graduated cylinder from 25.1 mL to 30.1 mL. What is the density of the object?

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**Write the following numbers in scientific notation.**

12- 0.0045834 mm \_\_\_\_\_

13- 7,004,300,000 g \_\_\_\_\_

**Write the following numbers in ordinary notation.**

14-  $3.02 \times 10^{-5}$  s \_\_\_\_\_

15-  $8.348 \times 10^6$  km \_\_\_\_\_

**Complete the following addition and subtraction problems in scientific notation.**

16-  $(6.23 \times 10^6 \text{ kL}) + (5.34 \times 10^5 \text{ kL})$

---

---

17-  $(4.68 \times 10^{-5} \text{ cg}) - (3.5 \times 10^{-6} \text{ cg})$

---

---

18-  $(4.8 \times 10^5 \text{ km}) \times (2.0 \times 10^3 \text{ km})$

---

---

19-  $(8.4 \times 10^6 \text{ L}) \div (2.4 \times 10^{-3} \text{ L})$

---

---

**Use dimensional analysis and conversion factors to convert:**

20- 783 kg to grams

---

---

21- 45.3 mm to meters

---

---

**Round each number to four significant figures.**

22- 0.0098641 cg \_\_\_\_\_

23- 431,801 kg \_\_\_\_\_

24- 1.21250 \_\_\_\_\_

**Round the answer for each problem to the correct number of significant figures.**

25-  $4.35 \text{ dm} \times 2.34 \text{ dm}$  \_\_\_\_\_

26-  $38,736 \text{ km} \div 4784 \text{ km}$  \_\_\_\_\_

28-  $(8.54 \times 10^{-3}) - (3.41 \times 10^{-4})$  \_\_\_\_\_

**The table** shows the data obtained by four groups of students during a lab investigation designed to determine the boiling point of methanol. The accepted value for the boiling point of methanol is  $78.5^{\circ}\text{C}$ .

	Group A	Group B	Group C	Group D
Trial 1	$79^{\circ}\text{C}$	$82^{\circ}\text{C}$	$75^{\circ}\text{C}$	$80^{\circ}\text{C}$
Trial 2	$78^{\circ}\text{C}$	$84.5^{\circ}\text{C}$	$83^{\circ}\text{C}$	$80.5^{\circ}\text{C}$
Trial 3	$83.5^{\circ}\text{C}$	$79^{\circ}\text{C}$	$78.5^{\circ}\text{C}$	$79.5^{\circ}\text{C}$
Average	$80.2^{\circ}\text{C}$	$81.8^{\circ}\text{C}$	$78.8^{\circ}\text{C}$	$80^{\circ}\text{C}$

29- which group data was the **most** accurate? \_\_\_\_\_

30- Which group data was the **most** precise? \_\_\_\_\_

31- which group data was the **least** accurate? \_\_\_\_\_

32- Which group data was the **least** precise? \_\_\_\_\_

33- Find the percent error in group C average value.

\_\_\_\_\_

\_\_\_\_\_

**A group** of students did an experiment to find the density of an unknown liquid, they changed the volume of the liquid then measured its mass, their results are listed in the table:

34- Identify the independent and the dependent variables:

The independent variable: \_\_\_\_\_

The dependent variable: \_\_\_\_\_

Volume (mL)	Mass (g)
2.0	5.4
4.0	10.8
6.0	16.2
8.0	21.6
10.0	27.0

35- Graph the data.

36- label the two axes.

37- Name the graph.

38- Find the slope.

\_\_\_\_\_

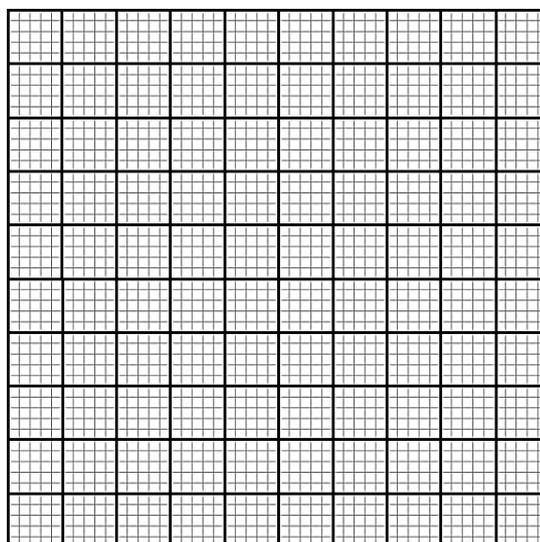
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



39- use the graph to find the volume if the mass is 13.5g \_\_\_\_\_

40- use the graph to find the mass if the volume is 12 mL \_\_\_\_\_



# Light and Quantized Energy

## Chapter 4 Revision

### 4.1 Early Ideas About Matter

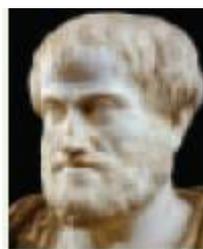
1-Democritus believed that matter was made up of \_\_\_\_\_

- A) earth
- B) fire
- C) atoms
- D) water



2-Aristotle said that \_\_\_\_\_ cannot exist.

- A) atoms
- B) empty space
- C) air
- D) fire

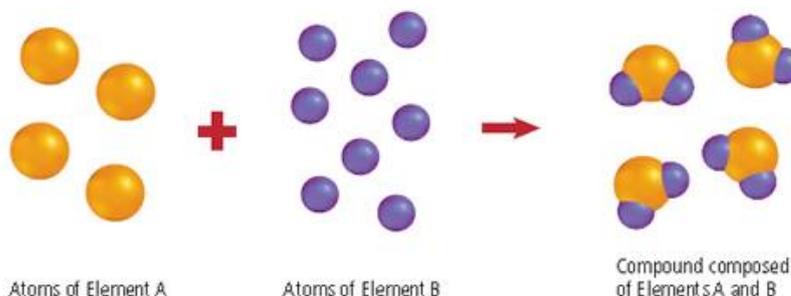


3- Which of the following parts of John Dalton's atomic theory were not correct?

- A) matter is composed of atoms
- B) atoms are indivisible
- C) atoms of one element differ from atoms of another
- D) atoms combine to form compounds

4- In the figure above, if atoms of element A have a mass of 16 units and atoms of element B have a mass of 1 unit, what will be the total mass?

- A) 72 units
- B) 12 units
- C) 18 units
- D) 17 units



5- John Dalton's ideas about atoms were similar to those of \_\_\_\_\_.

- A) Aristotle
- B) Plato
- C) Socrates
- D) Democritus

In your textbook, read about the philosophers, John Dalton, and defining the atom. For each statement below, write true or false.

- \_\_\_\_\_ 6- Ancient philosophers regularly performed controlled experiments.
- \_\_\_\_\_ 7- Philosophers formulated explanations about the nature of matter based on their own experiences.
- \_\_\_\_\_ 8- Both Democritus and Dalton suggested that matter is made up of atoms.
- \_\_\_\_\_ 9- Dalton's atomic theory stated that atoms separate, combine, or rearrange in chemical reactions.
- \_\_\_\_\_ 10- Dalton's atomic theory stated that matter is mostly empty space.
- \_\_\_\_\_ 11- Dalton was correct in thinking that atoms could not be divided into smaller particles.
- \_\_\_\_\_ 12- Dalton's atomic theory stated that atoms of different elements combine in simple whole-number ratios to form compounds.
- \_\_\_\_\_ 13- Dalton thought that all atoms of a specific element have the same mass.
- \_\_\_\_\_ 14- Democritus proposed that atoms are held together by chemical bonds, but no one believed him.
- \_\_\_\_\_ 15- Dalton's atomic theory was based on careful measurements and extensive research.

## Section 4.2 Defining the Atom

16- What can you conclude from the deflection of a cathode ray in a magnetic field?

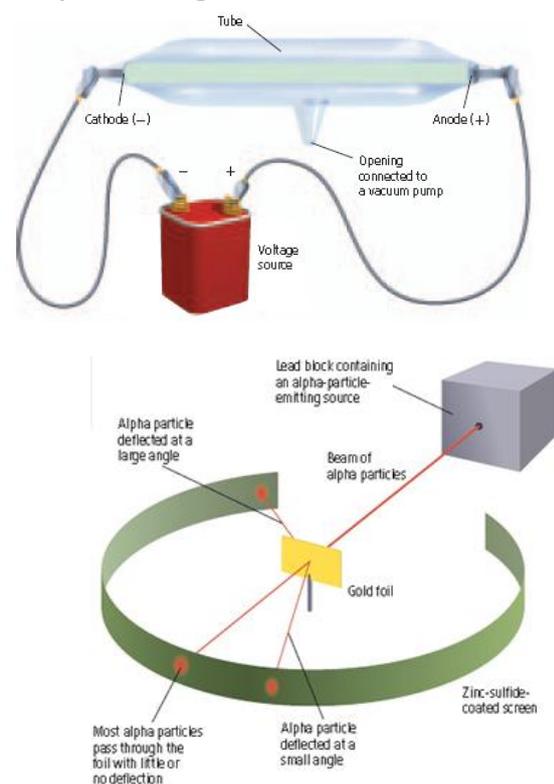
- A) The ray must be composed of charged particles.
- B) The ray must be composed of iron.
- C) The ray must have a positive charge.
- D) The ray must need to travel in a vacuum.

17- What properties did Rutherford use in the design of the gold foil experiment?

- A) alpha particle's negative charge and random distribution of protons
- B) alpha particle's negative charge and gold foil's positive charge
- C) alpha particle's positive charge and electron's negative charge
- D) positively charged electrons distributed in a uniform negative charge

18- Which of the following particles has a mass that is almost the same as the mass of a proton?

- A) neutron
- B) electron
- C) positron
- D) beta particle

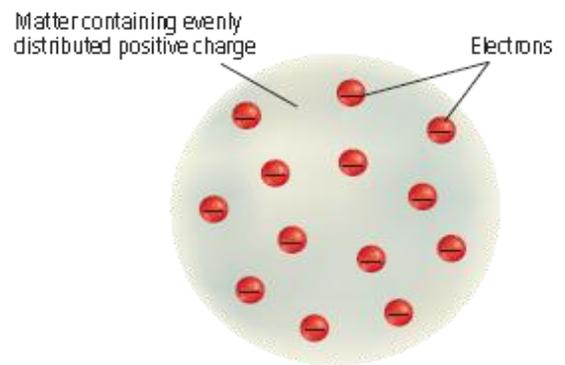


19- Which scientist determined that almost all of an atom's mass is located in its nucleus?

- A) Dalton
- B) Democritus
- C) Rutherford
- D) Thomson

20- In the plum pudding model of the atom, where is most of the mass of the atom?

- A) in the electrons
- B) in the matter between the electrons
- C) in the nucleus
- D) in the protons



**In your textbook, read about the electron and the nuclear atom.**

**For each item in Column A, write the letter of the matching item in Column B.**

**Column A**

- \_\_\_\_\_ 21- Proposed the nuclear atomic model
- \_\_\_\_\_ 22- Determined the mass-to-charge ratio of an electron
- \_\_\_\_\_ 23- Calculated the mass of an electron

**Column B**

- a- Thomson
- b- Millikan
- c- Rutherford

**Draw and label a diagram of each atomic model.**

24- plum pudding model

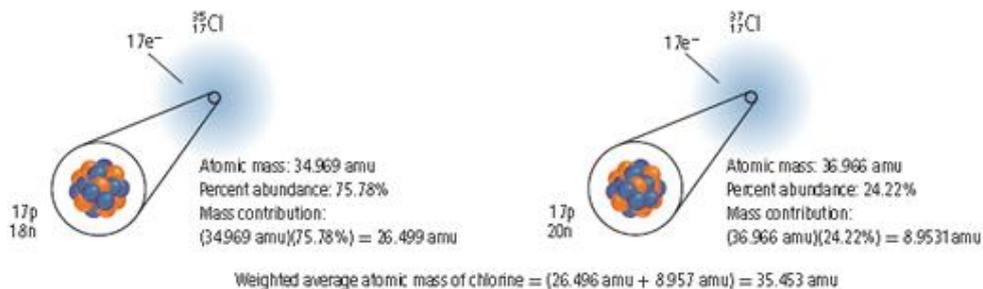
25- nuclear atomic model

26- In your textbook, read about the discovery of protons and neutrons. Complete the following table of proton, electron, and neutron characteristics.

Particle	Symbol	Location	Relative Charge	Relative Mass
Proton				
	n			
				1/1840

## Section 4.3 How Atoms Differ

27- Why are all atomic masses not nearly whole numbers?



- A) This is due to the mass of all the electrons in the atom.  
B) This is because of experimental error.  
C) This is because atomic masses are the weighted average of the masses of all naturally-occurring isotopes.  
D) This is due to binding energy of the atoms.
- 28- The atomic number of an element is defined by its number of \_\_\_\_\_.  
A) protons                      B) neutrons                      C) electrons                      D) nuclei
- 29- The sum of the protons and neutrons in a nucleus is \_\_\_\_\_.  
A) the atomic number                      B) the mass number  
C) Avogadro's number                      D) the element number
- 30- Which of the following is true for any atom?  
A) atomic number = number of protons = number of electrons  
B) atomic number = number of neutrons = number of electrons  
C) mass number = number of protons = number of electrons  
D) mass number = number of protons = number of neutrons
- 31- How is the atomic mass unit (amu) defined?  
A) 1/12 the mass of a carbon-12 atom                      B) 1/14 the mass of a nitrogen-14 atom  
C) 1/13 the mass of a carbon-13 atom                      D) 1/16 the mass of an oxygen-16 atom

In your textbook, read about atomic number.

For each statement below, write true or false.

- \_\_\_\_\_ 32- The number of neutrons in an atom is referred to as its atomic number.
- \_\_\_\_\_ 33- The periodic table is arranged by increasing atomic number.
- \_\_\_\_\_ 34- Atomic number is equal to the number of electrons in an atom.
- \_\_\_\_\_ 35- The number of protons in an atom identifies it as an atom of a particular element.
- \_\_\_\_\_ 36- Most atoms have either a positive or a negative charge.

**Answer the following questions.**

37- Lead has an atomic number of 82. How many protons and electrons does lead have?  
\_\_\_\_\_

38- Oxygen has 8 electrons. How many protons does oxygen have? \_\_\_\_\_

39- Zinc has 30 protons. What is its atomic number? \_\_\_\_\_

40- Astatine has 85 protons. What is its atomic number? \_\_\_\_\_

41- Rutherfordium has an atomic number of 104. How many protons and electrons does it have? \_\_\_\_\_

42- Polonium has an atomic number of 84. How many protons and electrons does it have?  
\_\_\_\_\_

43- Nobelium has an atomic number of 102. How many protons and electrons does it have?  
\_\_\_\_\_

**In your textbook, read about isotopes and mass number.**

**Determine the number of protons, electrons, and neutrons for each isotope described below.**

44- An isotope has atomic number 19 and mass number 39.  
\_\_\_\_\_

45- An isotope has 14 electrons and a mass number of 28.  
\_\_\_\_\_

46- An isotope has 21 neutrons and a mass number of 40.  
\_\_\_\_\_

47- An isotope has an atomic number 51 and a mass number 123.  
\_\_\_\_\_

**Answer the following question.**

48- Which of the isotopes in problems 29–32 are isotopes of the same element? Identify the element. \_\_\_\_\_

**Write each isotope below in symbolic notation. Use the periodic table to determine the atomic number of each isotope.**

49- neon-22 \_\_\_\_\_

50- cesium-133 \_\_\_\_\_

51- helium \_\_\_\_\_

52- uranium-234 \_\_\_\_\_

Label the mass number and the atomic number on the following isotope notation.

53- \_\_\_\_\_   $^{24}\text{Mg}$

54- \_\_\_\_\_   $^{12}\text{Mg}$

**In your textbook, read about mass of individual atoms.**

Circle the letter of the choice that best completes the statement.

55- The mass of an electron is:

a- smaller than the mass of a proton.

c- a tiny fraction of the mass of an atom.

b- smaller than the mass of a neutron.

d- all of the above.

- 56- One atomic mass unit is:
- a- 1/12 the mass of a carbon-12 atom.
  - b- 1/16 the mass of an oxygen-16 atom.
  - c- exactly the mass of one proton.
  - d- approximately the mass of one proton plus one neutron.
- 57- The atomic mass of an atom is usually not a whole number because it accounts for:
- a- only the relative abundance of the atom's isotopes.
  - b- only the mass of each of the atom's isotopes.
  - c- the mass of the atom's electrons.
  - d- both the relative abundance and the mass of each of the atom's isotopes.

Use the figures to answer the following questions.

Osmium
76
Os
190.23

Niobium
41
Nb
92.906

- 58- What is the atomic number of osmium? \_\_\_\_\_
- 59- What is the chemical symbol for niobium? \_\_\_\_\_
- 60- What is the atomic mass of osmium? \_\_\_\_\_
- 61- What units is the atomic mass reported in? \_\_\_\_\_
- 62- How many protons and electrons does an osmium atom have? A niobium atom?

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Calculate the atomic mass of each element described below. Then use the periodic table to identify each element.

63-

Isotope	Mass (amu)	Percent Abundance
$^{63}\text{X}$	62.930	69.17
$^{65}\text{X}$	64.928	30.83

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64-

Isotope	Mass (amu)	Percent Abundance
$^{35}\text{X}$	34.969	75.77
$^{37}\text{X}$	36.966	24.23

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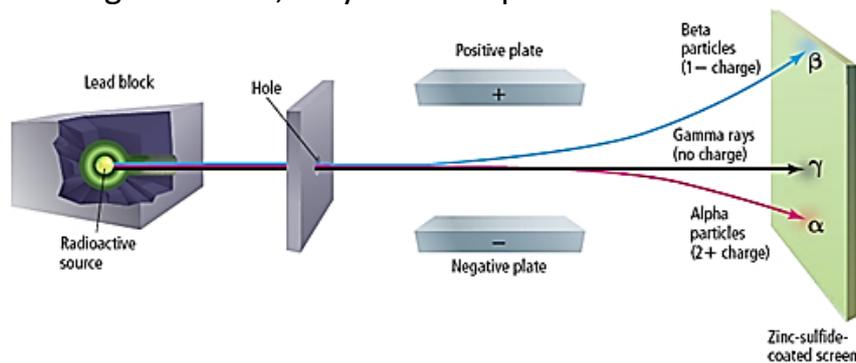
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# Section 4.4 Unstable Nuclei and Radioactive Decay

65- In the figure above, why are beta particles deflected more than alpha particles?



- A) Beta particles are less massive than alpha particles.
- B) Beta particles have a larger electric charge than alpha particles.
- C) Beta particles have more energy than the alpha particles.
- D) Beta particles have a negative electric charge.

66- What is the name for the emission of rays and particles by a radioactive material?

- A) radiation
- B) nuclear reactivity
- C) decay
- D) radioactive series

67- What is the charge of a gamma ray?

- A) 1+
- B) 2+
- C) 1-
- D) 0

68- What is the primary factor in determining an atom's stability?

- A) neutron to proton ratio
- B) proton to electron ratio
- C) neutron to electron ratio
- D) alpha particle to beta particle ratio

69- What is the charge of an alpha particle?

- A) 1+
- B) 2+
- C) 1-
- D) 0

In your textbook, read about radioactivity.

For each item in Column A, write the letter of the matching item in Column B.

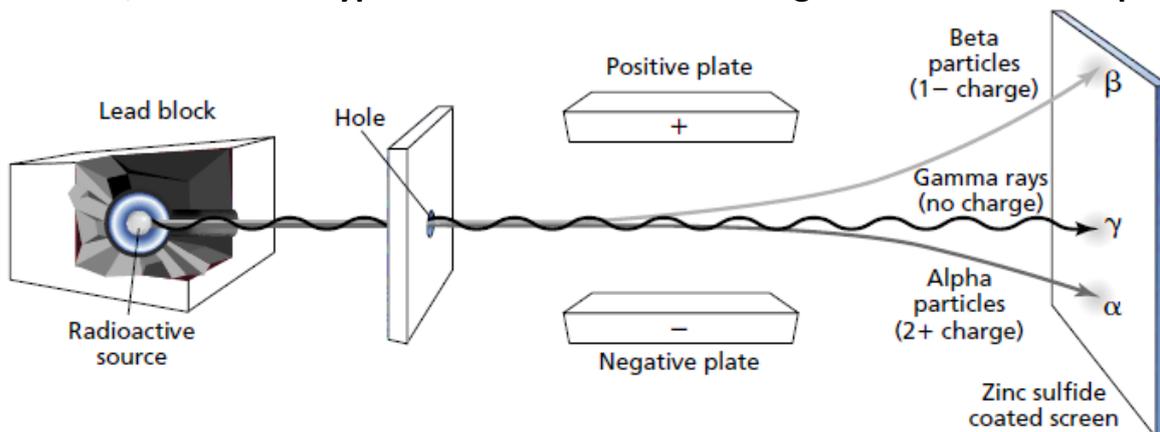
### Column A

- \_\_\_\_\_ 70- The rays and particles that are emitted by a radioactive material
- \_\_\_\_\_ 71- A reaction that involves a change in an atom's nucleus
- \_\_\_\_\_ 72- The process in which an unstable nucleus loses energy spontaneously
- \_\_\_\_\_ 73- Fast-moving electrons

### Column B

- a- nuclear reaction
- b- beta radiation
- c- Radiation
- d- radioactive decay

In your textbook, read about types of radiation. Use the diagram to answer the questions.



74- Which plate do the beta particles bend toward? Explain.

75- Explain why the gamma rays do not bend.

76- Explain why the path of the beta particles bends more than the path of the alpha particles.

77- Complete the following table of the characteristics of alpha, beta, and gamma radiation.

Radiation Type	Composition	Symbol	Mass (amu)	Charge
Alpha				
			1/1840	
	High-energy electromagnetic radiation			

## Standardized test practice

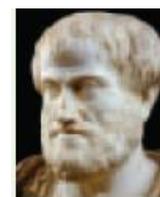
78- Why were Democritus's ideas not science?

- A) They were not supported by experiment.
- B) They were partly incorrect.
- C) They went against the ideas of more influential philosophers.
- D) They were ahead of their time.



79- Aristotle's ideas gained greater acceptance because \_\_\_\_\_.

- A) he backed up his ideas with experimental evidence.
- B) he tested his ideas.
- C) he was one of the most influential philosophers of his time.
- D) empty space cannot exist.

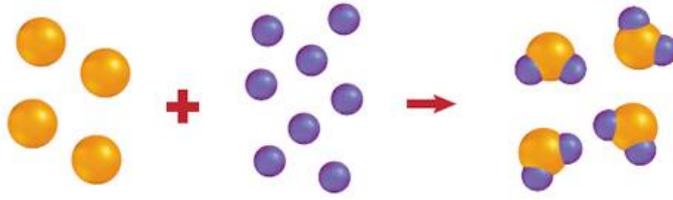


80- Which of the following was not a feature of John Dalton's atomic theory?

- A) careful observations and measurements
- B) discovery of the atom's internal structure
- C) mass ratios of elements involved in chemical reactions
- D) experiments that refined and supported his hypothesis

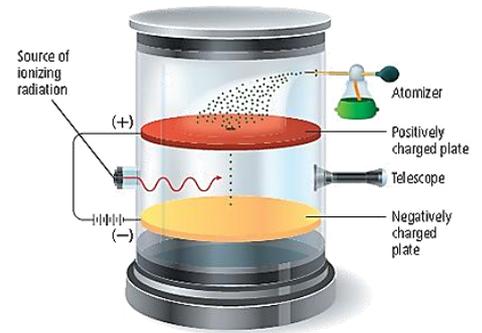


- 81- In the figure above, if atoms of element A have a mass of 12 units and atoms of element B have a mass of 1 unit, what is the total mass of the compound composed of elements A and B?



- A) 13 units      B) 15 units      C) 20 units      D) 56 units

- 82- In Millikan's Oil Drop Experiment (shown above), oil droplets are suspended in an electric field. What provides the downward force on the suspended droplets?



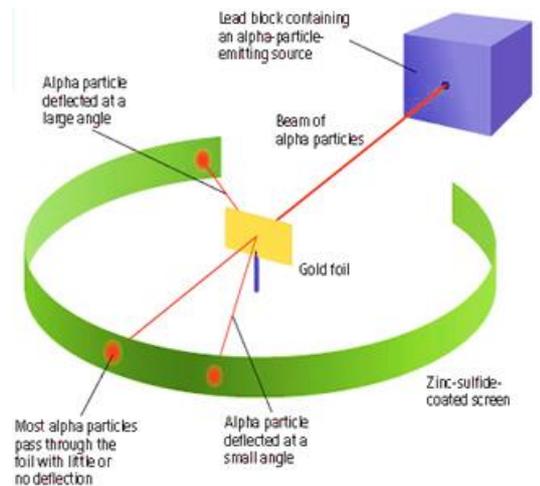
- A) the positive charge on the top plate  
 B) the negative charge on the bottom plate  
 C) gravity  
 D) the strong nuclear force

- 83- What is the negatively—charged particle in an atom?

- A) proton      B) positron  
 C) neutron      D) electron

- 84- Which of the following statements is correct?

- A) An electron is about 2000 times more massive than a proton.  
 B) A proton is about 2000 times more massive than an electron.  
 C) A neutron will always be found orbiting the nucleus.  
 D) The nucleus is negatively charged.



- 85- What can you infer about the alpha particle based on the diagram above?

- A) The alpha particle must have a positive electric charge.  
 B) The alpha particle must have a negative electric charge.  
 C) The alpha particle is about as massive as the gold nucleus.  
 D) The alpha particle is repelled by electrons.

- 86- What is the name for atoms of an element that have different masses?

- A) isotopes      B) isomers      C) allotropes      D) alloforms

- 87- How many protons are present in an atom potassium-39?

- A) 19      B) 20  
 C) 39      D) 58

88- Which of the following is a correct statement about a neutral atom?

- A) Neutrons are present in the nucleus.
- B) The atoms carry a positive or a negative charge.
- C) The atom has the same number of proton and electrons.
- D) The atom is radioactive.

89- Using information from the table, which type of radiation would be unaffected by an electric or magnetic field?

	Alpha	Beta	Gamma
Symbol	${}^4_2\text{He}$ or $\alpha$	$e^-$ or $\beta$	$\gamma$
Mass (amu)	4	$\frac{1}{1840}$	0
Mass (kg)	$6.65 \times 10^{-27}$	$9.11 \times 10^{-31}$	0
Charge	2+	1-	0

- A) alpha
- B) beta
- C) gamma
- D) all radiation is affected by electric and magnetic fields

90- What is the charge of a beta particle?

- A) 1+
- B) 2+
- C) 1-
- D) 0

91- How do gamma rays differ from alpha particles and beta particles?

- A) Alpha particle and beta particle emissions result in the formation of new atoms, whereas gamma ray emissions do not.
- B) Gamma rays and beta particles result in the formation of new atoms, but alpha particles do not.
- C) Gamma rays and alpha particles result in the formation of new atoms, but beta particles do not.
- D) Gamma rays have mass, whereas alpha and beta particles do not.

92- Unlike chemical reactions, nuclear reactions produce \_\_\_\_\_.

- A) energy
- B) new elements
- C) molecules
- D) light

Name: .....

9\ .....

**For each statement below, write true or false:**

- \_\_\_\_\_ 1- Democritus believed that matter was made up of earth, water, air and fire.
- \_\_\_\_\_ 2- Aristotle said that empty space cannot exist.
- \_\_\_\_\_ 3- Dalton Said that atoms combine in simple whole-number ratios to form compounds.
- \_\_\_\_\_ 4- Dalton's atomic theory helped in explaining the conservation of mass.
- \_\_\_\_\_ 5- Cathode rays deflect towards the negatively charged plate.
- \_\_\_\_\_ 6- Rutherford determined that almost all of an atom's mass is located in its nucleus.
- \_\_\_\_\_ 7- The atomic masses are not whole numbers because they are weighted average of the masses of all naturally-occurring isotopes.
- \_\_\_\_\_ 8- For all atoms, (atomic number = number of neutrons = number of electrons).
- \_\_\_\_\_ 9- An Alpha particle is a negatively charged helium nucleus.
- \_\_\_\_\_ 10- Gamma rays are deflected towards the negatively charged plate.

**For each statement below, circle the right answer:**

- 11- The charge and mass of the electron were determined by \_\_\_\_\_.  
A) Cathode ray tubes                      B) Millikan oil drop  
C) Gold foil experiment                      D) Studying chemical reactions.
- 12- Which particle has a mass that is almost the same as the mass of a proton?  
A) beta particle      B) electron      C) positron      D) neutron
- 13- Find the number of neutrons if an isotope has 14 electrons and a mass number of 29  
A) 14 Neutrons      B) 29 Neutrons      C) 43 Neutrons      D) 15 Neutrons
- 14- How many electrons are in the atom of lead  $^{204}_{82}Pb$ :  
A) 204 Electrons      B) 82 Electrons      C) 286 Electrons      D) 122 Electrons
- 15- Which of the following is **Not** an isotope of  $^{39}_{19}K$  .  
A)  $^{41}_{19}W$       B)  $^{40}_{20}X$       C)  $^{40}_{19}Y$       D)  $^{42}_{19}Z$
- 16- The equation  $^{238}_{92}U \rightarrow ^{234}_{90}Th + ^4_2He + \gamma$  represents  
A)  $\alpha$  decay      B)  $\beta$  decay      C)  $\gamma$  decay      D) Chemical reaction
- 17- In the equation  $^{234}_{90}Th \rightarrow ^{234}_{91}Pa + X + \gamma$  the unknown radiation X represents:  
A)  $\alpha$       B)  $\beta$       C)  $\gamma$       D) Unknown
- 18- 1/12 of the mass of  $^{12}_6C$  is the:  
A) amu      B) Atomic number      C) Mass number      D) Atomic mass
- 19- Unlike chemical reactions, nuclear reactions produce \_\_\_\_\_.  
A) energy      B) new elements      C) molecules      D) light
- 20- How many protons and neutrons are in the nucleus of Rubidium  $^{85}_{37}Rb$ :  
A) 37P and 85n      B) 37P and 48n      C) 85P and 37n      D) 48P and 48n

Complete the following table (Questions 21-25)

Properties of subatomic particles				
Particle (21)	Symbol (22)	Location (23)	Relative electric charge (24)	Relative Mass (25)
Proton			+1	
	$e^-$		-1	
	n	Inside the nucleus		

26- Use the data in the table to calculate the atomic mass of the unknown element.

27- Identify the element.

Isotope	Mass (amu)	Natural Abundance
$^{32}\text{X}$	31.974	94.99%
$^{33}\text{X}$	32.973	0.76%
$^{34}\text{X}$	33.971	4.25

Complete the following Table. (Questions 28-32)

Radiation Type (28)	Composition (29)	Symbol (30)	Mass (amu) (31)	Charge (32)
		$\alpha, {}^4_2\text{He}$		+2
Beta			$\frac{1}{1840}$	
	High-energy electromagnetic radiation			0

Plutonium ( $^{244}_{94}\text{Pu}$ ) decays by emitting one alpha particle, one beta particle, and one gamma ray.

33- Complete the equation for the Alpha decay  $^{244}_{94}\text{Pu} \rightarrow \text{---X} + \text{---}$

34- Complete the equation for the Beta and Gamma decays  $\text{---X} \rightarrow \text{---Y} + {}^0_{-1}\beta + \gamma$

35- Identify (Name) the element Y in the equation above. \_\_\_\_\_

Complete the following Table: (Questions 36-40)

Isotope	Symbol (36)	Atomic Number (37)	Mass Number	Number of Protons (38)	Number of Electrons (39)	Number of Neutrons (40)
Chlorine-35	$^{35}_{17}\text{Cl}$	17	35		17	
Chlorine-37	$\text{---Cl}$		37	17		20



# Electrons in Atom

## Revision

### 5.1 Light and Quantized Energy

In your textbook, read about the wave nature of light.

Use each of the terms below just once to complete the passage.

Amplitude    energy    frequency    hertz    light    wave    wavelength    speed

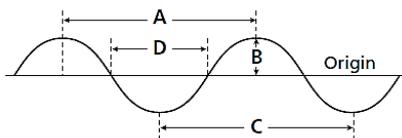
Electromagnetic radiation is a kind of (1) \_\_\_\_\_ that behaves like a(n) (2) \_\_\_\_\_ as it travels through space. (3) \_\_\_\_\_ is one type of electromagnetic radiation.

Other examples include X rays, radio waves, and microwaves. All waves can be characterized by their wavelength, amplitude, frequency, and (4) \_\_\_\_\_ .

The shortest distance between equivalent points on a continuous wave is called a(n) (5) \_\_\_\_\_ .

The height of a wave from the origin to a crest or from the origin to a trough is the (6) \_\_\_\_\_. (7) \_\_\_\_\_ is the number of waves that pass a given point in one second. The SI unit for frequency is the (8) \_\_\_\_\_ , which is equivalent to one wave per second.

Use the figure to answer the following questions.



9- Which letter(s) represent one wavelength? \_\_\_\_\_

10- Which letter(s) represent the amplitude? \_\_\_\_\_

11- If twice the length of A passes a stationary point every second, what is the frequency of the wave? \_\_\_\_\_

In your textbook, read about the particle nature of light.

Circle the letter of the choice that best completes the statement or answers the question.

12. A(n) \_\_\_\_\_ is the minimum amount of energy that can be lost or gained by an atom.

A) valence electron

B) electron

C) quantum

D) Planck's constant

13- According to Planck's theory, for a given frequency,  $\nu$ , matter can emit or absorb energy only in

A) units of hertz.

B) whole-number multiples of  $h\nu$ .

C) entire wavelengths.

D) multiples of  $\frac{1}{2}h\nu, \frac{1}{4}h\nu$ , and so on.



Look at the figure to answer Q 28-35:

28- What kinds of waves have the longest wavelength? \_\_\_\_\_  
 shortest wavelength? \_\_\_\_\_

29- Which waves have the lowest frequency? \_\_\_\_\_

30- Which has a higher frequency: microwaves or X rays?  
 \_\_\_\_\_

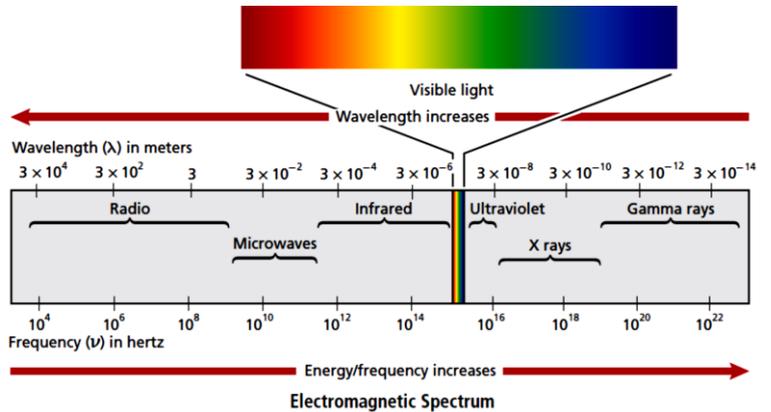
31- Which waves can be seen by the eye? \_\_\_\_\_

32- Sequence the different segments of the visible spectrum in order from shortest wavelength to longest wavelength.  
 \_\_\_\_\_

33- Sequence the following types of waves from lowest frequency to highest frequency: ultraviolet rays, infrared rays, gamma rays, radio waves, and green light.  
 \_\_\_\_\_

34- Compare the wavelengths and frequencies of each kind of wave. What is the relationship between frequency and wavelength?  
 \_\_\_\_\_

35- What is the wavelength of a radio station emitting its signal at 95.5 MHz? Estimate your answer to the nearest power of ten.  
 \_\_\_\_\_  
 \_\_\_\_\_



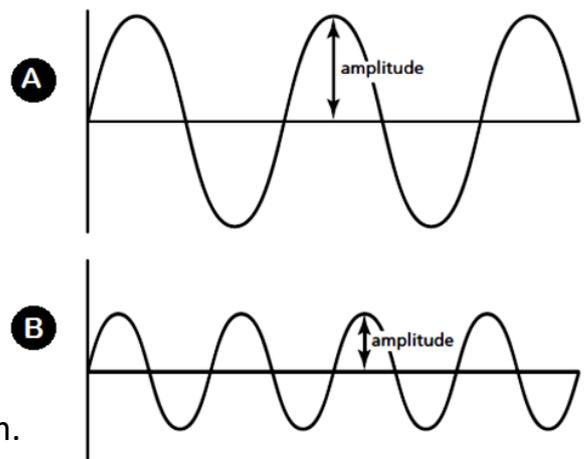
Look at the two waves shown to answer Q 36-41:

36-What is the speed of each wave?  
 \_\_\_\_\_

37- Which wave has a higher frequency?  
 \_\_\_\_\_

Which wave has a longer wavelength?  
 \_\_\_\_\_

38- Assume that wave A has a wavelength of 699 nm. Calculate the frequency of the wave. Show your work.



**Waves A and B are both electromagnetic waves.**

$c = \lambda\nu$  for all electromagnetic waves.

**39-** Assume that wave B has a wavelength of 415 nm. Calculate the frequency of the wave. Show your work.

**40-** Compare your calculations in question 4 with your answer to question 3. Do your calculations support your answer in question 2?

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**41-** If wave A has a frequency of  $4.60 \times 10^{14} \text{ s}^{-1}$ , what is its wavelength in nanometers? Show your work.

**Solve the following word problems following the same procedure in the first problem:**

<b>42</b>	A wave has a wavelength of 0.025m, find its frequency?			
	Given	Equation	Work	Final answer
	$c=3 \times 10^8 \text{ m/s}$ $\lambda=0.025 \text{ m}$	$v = c/\lambda$	$v = \frac{c}{\lambda} = 3 \times 10^8 \div 0.025$ $= 1.2 \times 10^{10} \text{ Hz}$	$= 1.2 \times 10^{10} \text{ Hz}$

<b>43</b>	A wave has a wavelength of 0.0212m, find its frequency?			
	Given	Equation	Work	Final answer

<b>44</b>	What is the wavelength of the wave that has a frequency of $3 \times 10^{14} \text{ Hz}$ ?			
	Given	Equation	Work	Final answer

<b>45</b>	Find the speed of the wave that has a wavelength of 0.7nm and a frequency of 10MHz, Does it belong to the electromagnetic spectrum?			
	Given	Equation	Work	Final answer

46	Find the speed of the wave that has a wavelength of $1.2 \times 10^{-5} \text{m}$ and a frequency of $2.5 \times 10^{13} \text{Hz}$ , Does it belong to the electromagnetic spectrum?			
	Given	Equation	Work	Final answer

47	What is the frequency of the wave that has a wavelength of $3 \mu\text{m}$ ?			
	Given	Equation	Work	Final answer

48	What is the wavelength of a wave that has a frequency of $1 \times 10^6 \text{ Hz}$ ? To which part of the spectrum does this wave belong?			
	Given	Equation	Work	Final answer

**Solve the following word problems:**

49- Ultraviolet radiation has a frequency of  $6.8 \times 10^{15} \text{ Hz}$ . Calculate the energy, in joules, of the photon.

- **Find the energy**  $E_{\text{photone}} = h\nu$  \_\_\_\_\_

50- Find the energy, in joule of microwave radiation with a frequency of 79.1 GHz.

- **Convert  $\nu$  to Hz**  $1 \text{GHz} = 10^9 \text{Hz}$  \_\_\_\_\_

- **Find the energy**  $E_{\text{photone}} = h\nu$  \_\_\_\_\_

51- A sodium vapor lamp emits light photons with a wavelength of  $5.89 \times 10^{-7} \text{ m}$ . What is the energy of these photons?

- **Find the frequency**  $\nu = c/\lambda$  \_\_\_\_\_

- **Find the energy**  $E_{\text{photone}} = h\nu$  \_\_\_\_\_

52- One of the electron transitions in a hydrogen atom produces infrared light with a wavelength of  $7.464 \times 10^{-6} \text{ m}$ . What amount of energy causes this transition?

- **Find the frequency**  $\nu = c/\lambda$  \_\_\_\_\_

- **Find the energy**  $E_{\text{photone}} = h\nu$  \_\_\_\_\_

53- Find the energy in kJ for an x-ray photon with a frequency of  $2.4 \times 10^{18}$  Hz.

- Find the energy  $E_{\text{photone}} = h\nu$  \_\_\_\_\_

- Convert E to kJ  $1\text{kJ} = 1000\text{J}$  \_\_\_\_\_

54- A ruby laser produces red light that has a wavelength of 500 nm. Calculate its energy in joules.

- Convert  $\lambda$  to m  $1\text{m} = 10^9\text{nm}$   
\_\_\_\_\_

- Find the frequency  $\nu = c/\lambda$  \_\_\_\_\_

- Find the energy  $E_{\text{photone}} = h\nu$  \_\_\_\_\_

55- What is the frequency of UV light that has an energy of  $2.39 \times 10^{-18}$  J?

- Find the frequency  $\nu = E/h$  \_\_\_\_\_

56- What is the wavelength and frequency of photons with an energy of  $1.4 \times 10^{-21}$  J?

- Find the frequency  $\nu = E/h$  \_\_\_\_\_

- Find the wavelength  $\lambda = c/\nu$  \_\_\_\_\_

57- An electromagnetic wave has a frequency of 11MHz find the photon energy and wave length.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

58- A microwave oven is heating a bowl of soup, the energy needed for the soup to get hot is  $3.8 \times 10^4$  J, if the microwaves frequency is  $2.9 \times 10^{10}$  Hz how many quanta are needed to provide the energy needed to heat the soup? (keep the correct number of sig. fig)

\_\_\_\_\_  
\_\_\_\_\_

# Section 5.2 Quantum Theory and the Atom

In your textbook, read about the Bohr model of the atom.

Use each of the terms below to complete the statements.

atomic emission spectrum	electron	frequencies	ground state
higher energy levels	lower		

- 59- The lowest allowable energy state of an atom is called its \_\_\_\_\_.
- 60- Bohr's model of the atom predicted the \_\_\_\_\_ of the lines in hydrogen's atomic emission spectrum.
- 61- According to Bohr's atomic model, the smaller an electron's orbit, the \_\_\_\_\_ the atom's energy level.
- 62- Bohr proposed that when energy is added to a hydrogen atom, its \_\_\_\_\_ moves to a higher-energy orbit.
- 63- According to Bohr's atomic model, the hydrogen atom emits a photon corresponding to the difference between the \_\_\_\_\_ associated with the two orbits it transitions between.
- 64- Bohr's atomic model failed to explain the \_\_\_\_\_ of elements other than hydrogen.

In your textbook, read about the quantum mechanical model of the atom.

Answer the following questions.

- 65- If you looked closely, could you see the wavelength of a fast-moving car? Explain your answer.

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- 66- Using de Broglie's equation,  $\lambda = \frac{h}{mv}$  which would have the larger wavelength, a slow-moving proton or a fast-moving golf ball? Explain your answer.

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In your textbook, read about the Heisenberg uncertainty principle.

For each item in Column A, write the letter of the matching item in Column B.

### Column A

- \_\_\_\_\_ 67- The modern model of the atom that treats electrons as waves
- \_\_\_\_\_ 68- States that it is impossible to know both the velocity and the position of a particle at the same time
- \_\_\_\_\_ 69- A three-dimensional region around the nucleus representing the probability of finding an electron
- \_\_\_\_\_ 70- Originally applied to the hydrogen atom, it led to the quantum mechanical model of the atom

### Column B

- a. Heisenberg uncertainty principle
- b. Schrödinger wave equation
- c. quantum mechanical model of the atom

Answer the following question.

71- How do the Bohr model and the quantum mechanical model of the atom differ in how they describe electrons?

In your textbook, read about hydrogen's atomic orbitals.

In the space at the left, write the term in parentheses that correctly completes the statement.

- \_\_\_\_\_ 72- Atomic orbitals (do, do not) have an exactly defined size.  
 \_\_\_\_\_ 73- Each orbital may contain at most (two, four) electrons.  
 \_\_\_\_\_ 74- All s orbitals are (spherically shaped, dumbbell shaped).  
 \_\_\_\_\_ 75- A principal energy has (n, n<sup>2</sup>) energy sublevels.  
 \_\_\_\_\_ 76- The maximum number of (electrons, orbitals) related to each principal energy level equals 2n<sup>2</sup>.  
 \_\_\_\_\_ 77- There are (three, five) equal energy p orbitals.  
 \_\_\_\_\_ 78- Hydrogen's principal energy level 2 consists of (2s and 3s, 2s and 2p) orbitals.  
 \_\_\_\_\_ 79- Hydrogen's principal energy level 3 consists of (nine, three) orbitals.

80- What is the maximum number of electrons that can be present in each principal energy level of hydrogen?

- A) n  
 B) n<sup>2</sup>  
 C) 2n  
 D) 2n<sup>2</sup>

Principal Quantum Number (n)	Sublevels (Types of Orbitals) Present	Number of Orbitals Related to Sublevel	Total Number of Orbitals Related to Principal Energy Level (n <sup>2</sup> )
1	s	1	1
2	s p	1 3	4
3	s p d	1 3 5	9
4	s p d f	1 3 5 7	16

81- What is the lowest energy state of an atom called?

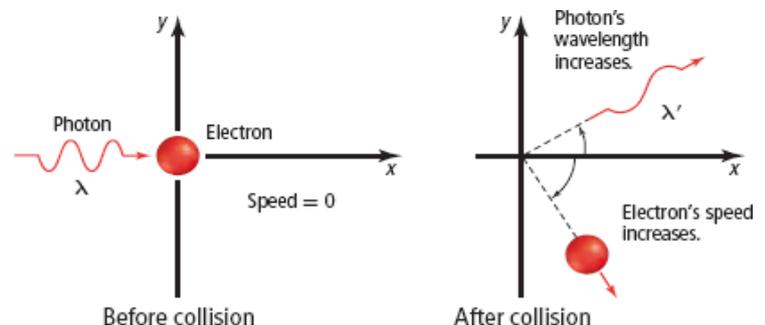
- A) the ground state                      B) the excited state  
 C) the solid state                         D) the chaotic state

82- The concept that all moving particles have wave characteristics is attributed to \_\_\_\_\_.

- A) de Broglie                      B) Thomson  
 C) Heisenberg                      D) Bohr

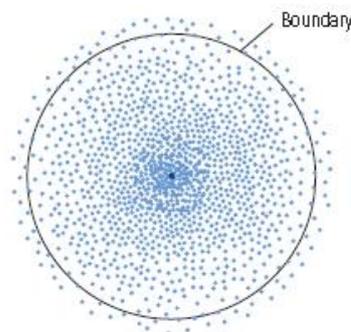
83- In the figure, why must the photon's wavelength increase after the collision?

- A) The photon changes direction.  
 B) The photon changes speed.  
 C) The photon gives up some energy to the electron.  
 D) The photon starts spinning.



84- In the figure, why are there dots beyond the "boundary" of the atomic orbital?

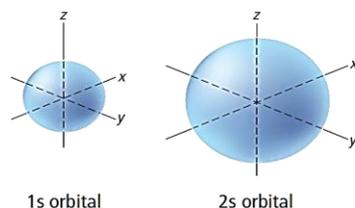
- A) the boundary encloses the volume in which the electron is found 90% of the time
- B) the boundary is three-dimensional, while the picture shows only two dimensions
- C) experimental error
- D) the boundary encloses the volume in which the electron is found 50% of the time



Study the diagram below to answer Q 85-93

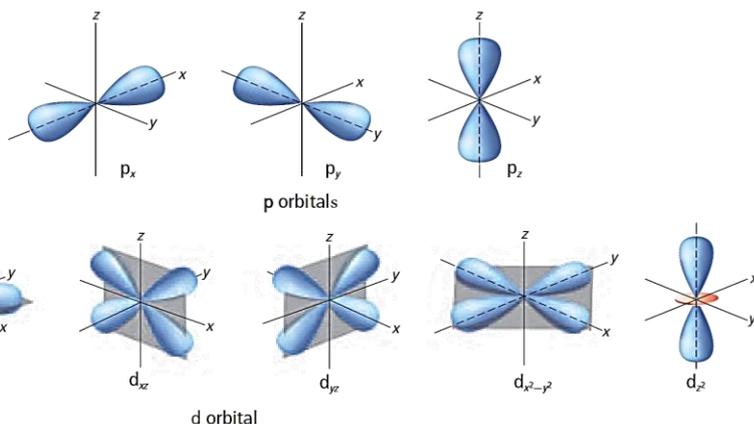
85- What is the shape of an s orbital?

\_\_\_\_\_



86- What is the relationship between the size of an s orbital and the principal energy level in which it is found?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



87- What is the shape of a p orbital? How many p orbitals are there in a sublevel?

\_\_\_\_\_

88- How many electrons can each orbital hold? \_\_\_\_\_

89- Look at the diagrams of the p orbitals. What do x, y, and z refer to? \_\_\_\_\_

90- How many d orbitals are there in a given sublevel? How many total electrons can the d orbitals in a sublevel hold? \_\_\_\_\_

91- Which d orbitals have the same shape? \_\_\_\_\_

92- What point in each diagram represents an atom's nucleus? \_\_\_\_\_

93- How likely is it that an electron occupying a p or a d orbital would be found very near an atom's nucleus? What part of the diagram supports your conclusion?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# Section 5.3 Electrom Configuration

In your textbook, read about ground-state electron configurations.

Use each of the terms below just once to complete the passage.

Aufbau principle    electron configuration    ground-state electron configuration  
Hund's rule    lowest    Pauli exclusion principle    spins    stable

The arrangement of electrons in an atom is called the atom's (94) \_\_\_\_\_.

Electrons in an atom tend to assume the arrangement that gives the atom the (95) \_\_\_\_\_ possible energy. This arrangement of electrons is the most (96) \_\_\_\_\_ arrangement and is called the atom's (97) \_\_\_\_\_.

Three rules define how electrons can be arranged in an atom's orbitals. The (98) \_\_\_\_\_ states that each electron occupies the lowest energy orbital available. The (99) \_\_\_\_\_ states that a maximum of two electrons may occupy a single atomic orbital, but only if the electrons have opposite (100) \_\_\_\_\_. (101) \_\_\_\_\_ electrons with the same spin must occupy each equal-energy orbital before additional electrons with opposite spins occupy the same orbitals.

Complete the following table.

Element	Atomic Number	Orbitals					Electron Configuration
		1s	2s	2p <sub>x</sub>	2p <sub>y</sub>	2p <sub>z</sub>	
102. Helium							1s <sup>2</sup>
103.	7						
104. Neon		↑↓	↑↓	↑↓	↑↓	↑↓	

Answer the following questions.

105- What is germanium's atomic number? How many electrons does germanium have?

---

106-What is noble-gas notation?

---

107- Why do we use noble-gas notation to write electron configurations?

---

---

In your textbook, read about valence electrons.

Circle the letter of the choice that best completes the statement or answers the question.

108- The electrons in an atom's outermost orbitals are called

- A) electron dots.                      B) quantum electrons.  
C) valence electrons.                D) noble-gas electrons.

109-In an electron-dot structure, the element's symbol represents the

- A) nucleus of the noble gas closest to the atom in the periodic table.  
B) atom's nucleus and inner-level electrons.  
C) atom's valence electrons.  
D) electrons of the noble gas closest to the atom in the periodic table.

110-How many valence electrons does a chlorine atom have if its electron configuration is  $[\text{Ne}]3s^23p^5$ ?

- A) 3      B) 21      C) 5      D) 7

111-Given boron's electron configuration of  $[\text{He}]2s^22p^1$ , which of the following represents its electron-dot structure?

- A)  $\cdot\text{Be}\cdot$       B)  $\cdot\dot{\text{B}}\cdot$       C)  $\ddot{\text{B}}:$       D)  $\ddot{\text{Be}}$

112- Given beryllium's electron configuration of  $1s^22s^2$ , which of the following represents its electron-dot structure?

- A)  $\cdot\text{Be}\cdot$       B)  $\cdot\dot{\text{B}}\cdot$       C)  $\ddot{\text{B}}:$       D)  $\ddot{\text{Be}}$

113- How many electrons can an orbital contain?

- A) 1      B) 2      C) 3      D) 4

114- What is the electron configuration for tin (Sn)?

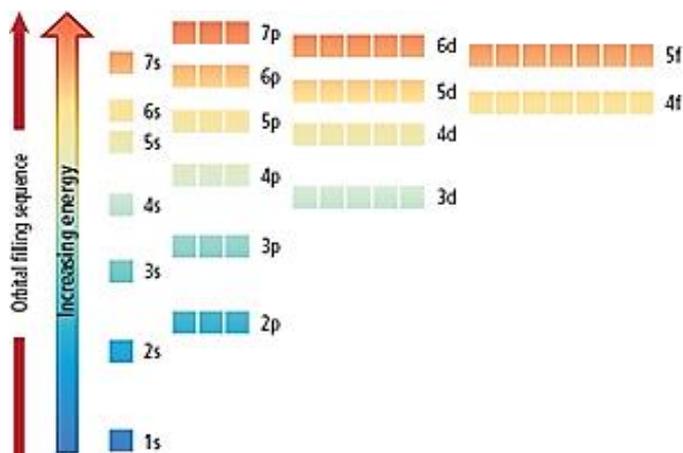
- A)  $[\text{Kr}]5s^23d^{10}3f^{14}5p^4$       B)  $[\text{Kr}]5s^23d^{10}4d^{14}5p^4$   
 C)  $[\text{Kr}]5s^23d^{10}4f^{14}5p^2$       D)  $[\text{Kr}]5s^24d^{10}5p^2$

115- What is an electron dot structure?

- A) An element symbol surrounded by dots representing its valence electrons.  
 B) An element symbol surrounded by its innermost electrons.  
 C) An element symbol with a positive charge.  
 D) A filled noble gas in brackets plus the remaining electron configuration expressed by filled orbitals.

116- Why does the 4s orbital begin to fill before the 3d orbital?

- A) The 4s orbital is lower than the 3d orbital in the aufbau diagram.  
 B) s orbitals always fill before d orbitals.  
 C) The 4s orbital is to the left of the 3d orbital in the diagram.  
 D) The 4s orbital has higher energy than the 3d orbital.



117- Which of the following statements expresses Hund's rule?

1.  $\uparrow\ \square\ \square$       2.  $\uparrow\uparrow\ \square$       3.  $\uparrow\uparrow\uparrow$

4.  $\uparrow\downarrow\uparrow\uparrow$       5.  $\uparrow\downarrow\uparrow\uparrow$       6.  $\uparrow\downarrow\uparrow\downarrow$

- A) Electrons in orbitals must possess opposite spins.  
 B) Single electrons with the same spin must occupy each equal-energy orbital before additional electrons with opposite spins can occupy the same orbitals.  
 C) Electrons with the same spin fill all orbitals.  
 D) P orbitals may contain up to six electrons.

Use the figure to answer Q 117-127

118- What does each small box in the diagram represent? \_\_\_\_\_

119- How many electrons can each orbital hold? \_\_\_\_\_

120- How many electrons can the d sublevel hold? \_\_\_\_\_

121- Which is associated with more energy: a 2s or a 2p orbital? \_\_\_\_\_

122- Which is associated with more energy: a 2s or a 3s orbital? \_\_\_\_\_

123- According to the aufbau principle, which orbital should fill first, a 4s or a 3d orbital? \_\_\_\_\_

124- Which orbital has the least amount of energy? \_\_\_\_\_

125- What is the likelihood that an atom contains a 1s orbital? \_\_\_\_\_

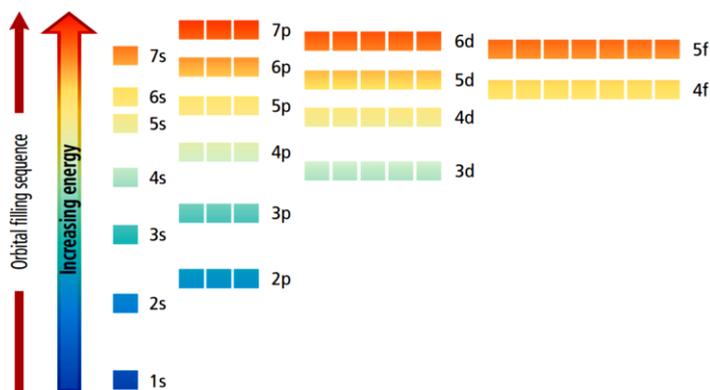
126- Sequence the following orbitals in the order that they should fill up according to the aufbau principle: 4d, 4p, 4f, 5s, 6s, 5p, 3d, 4s.

\_\_\_\_\_

\_\_\_\_\_

127- Write a general rule to describe the filling of orbitals in an atom.

\_\_\_\_\_



Draw the electron configuration of the following elements:

N	Symbol	Number of Electrons	Electron configuration																
128	S		<input type="checkbox"/>																
			1s	2s	2p			3s	3p			4s	3d						
129	K		<input type="checkbox"/>																
			1s	2s	2p			3s	3p			4s	3d						
130	Mn		<input type="checkbox"/>																
			1s	2s	2p			3s	3p			4s	3d						
131	N		<input type="checkbox"/>																
			1s	2s	2p			3s	3p			4s	3d						

Draw the electron configuration of the following elements:

N	Symbol	Number of Electrons	Electron configuration																
132	P		<input type="checkbox"/>																
			<b>1s</b>	<b>2s</b>	<b>2p</b>			<b>3s</b>	<b>3p</b>			<b>4s</b>	<b>3d</b>						
133	Cl		<input type="checkbox"/>																
			<b>1s</b>	<b>2s</b>	<b>2p</b>			<b>3s</b>	<b>3p</b>			<b>4s</b>	<b>3d</b>						
134	Al		<input type="checkbox"/>																
			<b>1s</b>	<b>2s</b>	<b>2p</b>			<b>3s</b>	<b>3p</b>			<b>4s</b>	<b>3d</b>						
135	Ca		<input type="checkbox"/>																
			<b>1s</b>	<b>2s</b>	<b>2p</b>			<b>3s</b>	<b>3p</b>			<b>4s</b>	<b>3d</b>						
136	Zn		<input type="checkbox"/>																
			<b>1s</b>	<b>2s</b>	<b>2p</b>			<b>3s</b>	<b>3p</b>			<b>4s</b>	<b>3d</b>						

Which of the following “rules” is being violated in each electron configuration below? Explain your answer for each. Hund’s Rule, Pauli Exclusion Principle, Aufbau Principle

N	Electron configuration	Rule violated	Explanation
137	$\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ <input type="checkbox"/> <input type="checkbox"/> 1s 2s 2p		
138	$\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ <input type="checkbox"/> $\uparrow\downarrow$ $\uparrow$ $\uparrow$ 1s 2s 2p 3s 3p		
139	$\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\uparrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ 1s 2s 2p 3s 3p		
140	$\uparrow\downarrow$ $\uparrow\downarrow$ 1s 2s 2p 3s 3p 3d		
141	$\uparrow\downarrow$ $\uparrow\downarrow$ 1s 2s 2p 3s 3p 4s 3d		
142	$\uparrow\downarrow$ $\uparrow\downarrow$ 1s 2s 2p 3s 3p 4s 3d		
143	$\uparrow\downarrow$ <input type="checkbox"/> $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ 1s 2s 2p 3s 3p 4s 3d		
144	$\uparrow\downarrow$ $\uparrow\downarrow$ 1s 2s 2p 3s 4s 3p 3d		

In the space below, write the expanded electron configurations (ex. =  $1s^22s^1$ ) of the following elements:

145- Sodium \_\_\_\_\_

146- Potassium \_\_\_\_\_

147- Chlorine \_\_\_\_\_

148- Bromine \_\_\_\_\_

149- oxygen \_\_\_\_\_

In the space below, write the abbreviated electron configurations (ex. Li=  $[\text{He}]2s^1$ ) of the following elements:

150- Manganese \_\_\_\_\_

151- Silver \_\_\_\_\_

152- Nitrogen \_\_\_\_\_

153- Sulphur \_\_\_\_\_

154- Argon \_\_\_\_\_

Determine what elements are denoted by the following electron configurations:

155-  $1s^22s^22p^63s^23p^4$  \_\_\_\_\_

156-  $1s^22s^22p^63s^23p^64s^23d^{10}4p^65s^1$  \_\_\_\_\_

157-  $[\text{Kr}] 5s^24d^{10}5p^3$  \_\_\_\_\_

158-  $[\text{Xe}] 6s^24f^{14}5d^6$  \_\_\_\_\_

159-  $[\text{Rn}] 7s^25f^{11}$  \_\_\_\_\_

How many valence electrons are present in:

160- Helium (He) \_\_\_\_\_

161- Carbon (C) \_\_\_\_\_

162- Neon (Ne) \_\_\_\_\_

163- Sodium (Na) \_\_\_\_\_

164- Potassium (K) \_\_\_\_\_

165- Fluorine (F) \_\_\_\_\_

166- Chlorine \_\_\_\_\_

167- Bromine \_\_\_\_\_

Draw Lewis Dot Structures for the following elements:

168- Helium (He)

169- Carbon (C)

170- Neon (Ne)

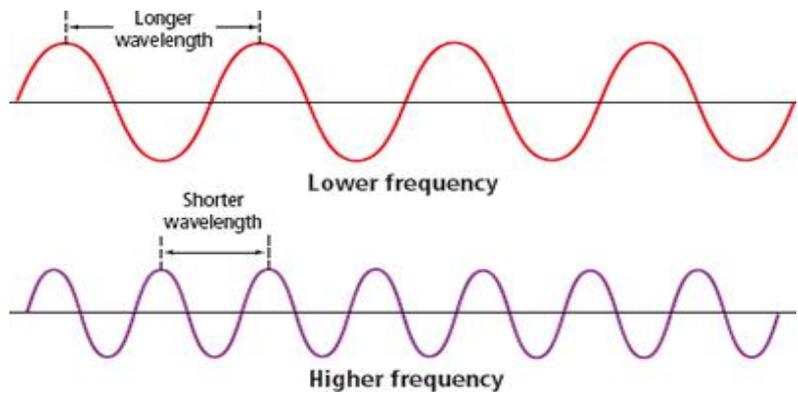
171- Sodium (Na)



# Standardized Test Practice

172- What is the frequency of yellow light, which has a wavelength of  $5.56 \times 10^{-7} \text{m}$ ?

- A)  $1.85 \times 10^{15} \text{ Hz}$
- B)  $1.85 \times 10^{15} \text{ m/s}$
- C)  $5.40 \times 10^{14} \text{ Hz}$
- D)  $5.40 \times 10^{14} \text{ m/s}$



173- The part of the electromagnetic spectrum that humans can see is the \_\_\_\_\_.

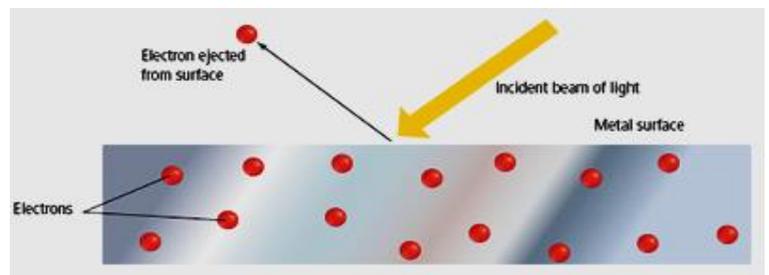
- A) visible spectrum
- B) infrared spectrum
- C) ultraviolet spectrum
- D) a, b, and c

174- A wavelength of 500 nm is associated with the \_\_\_\_\_ portion of the electromagnetic spectrum.

- A) visible
- B) infrared
- C) ultraviolet
- D) microwave

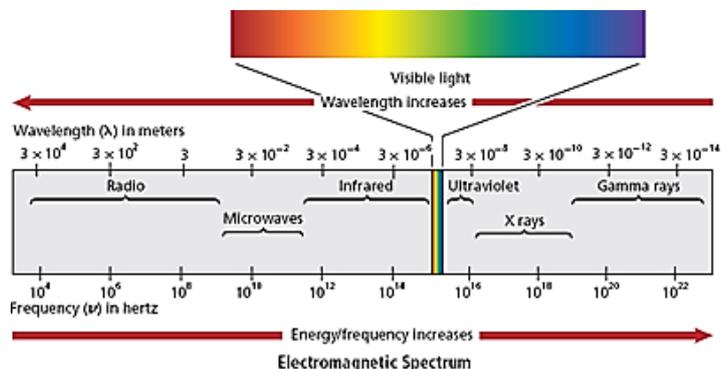
175- In the photoelectric effect, increasing the frequency of the light increases the \_\_\_ of the ejected electrons.

- A) number
- B) energy
- C) size
- D) wavelength



176- If a radio station were to increase its frequency from 94.5 MHz to 99.1 MHz, what would happen to the station's wavelength?

- A) The wavelength would not change.
- B) The wavelength would go up.
- C) The wavelength would go down.
- D) The wavelength would double.



177- The Heisenberg uncertainty principle states that \_\_\_\_\_.

- A) no two electrons in the same atom can have the same set of four quantum numbers
- B) two atoms of the same element must have the same number of protons
- C) it is impossible to simultaneously know the precise position and velocity of a particle
- D) electrons of atoms in their ground states enter energetically equivalent sets of orbitals singly before they pair up in any orbital of the set

178- The ground state of hydrogen corresponds to the \_\_\_\_\_.

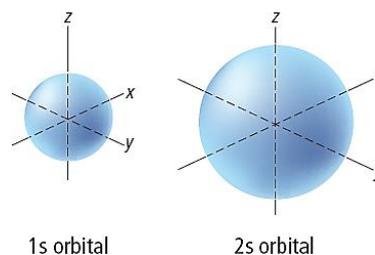
- A) zeroth energy level
- B) first energy level
- C) second energy level
- D) highest energy level

179- Which of the following statements is true?

- A) Each set of d orbitals contains seven orbitals.
- B) Each set of d orbitals can hold a maximum of 14 electrons.
- C) The first energy level contains only s and p orbitals.
- D) All s orbitals are spherically shaped.

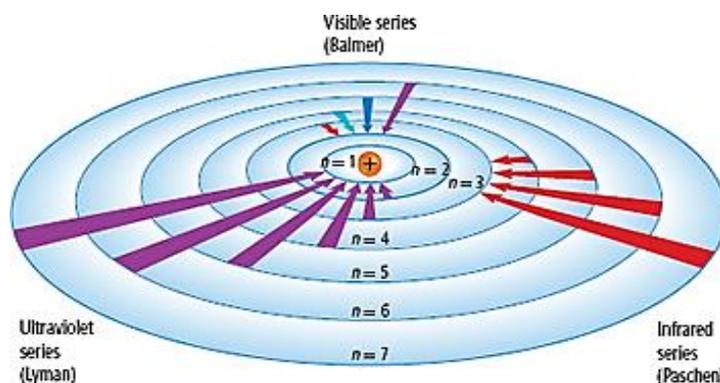
180- What is the primary difference between the 1s and the 2s orbitals?

- A) shape
- B) size
- C) number of electrons
- D) number of neutrons



181- In the Bohr model of the hydrogen atom, which of the following transitions results in light you can see?

- A)  $n = 6$  to  $n = 1$
- B)  $n = 6$  to  $n = 2$
- C)  $n = 6$  to  $n = 3$
- D)  $n = 6$  to  $n = 4$



182- The principle that states each electron occupies the lowest energy orbital available is the \_.

- A) aufbau principle
- B) uncertainty principle
- C) exclusion principle
- D) photoelectric principle

183- The valence orbitals in an atom are the \_.

- A) innermost orbitals
- B) second energy level
- C) d orbitals
- D) outermost orbitals

184- How many valence electrons does a group 1A metal atom have?

- A) 1
- B) 2
- C) 3
- D) 4

Element	Atomic Number	Orbital Diagram				Electron Configuration Notation	
		1s	2s	2p <sub>x</sub>	2p <sub>y</sub> 2p <sub>z</sub>		
Hydrogen	1	↑				1s <sup>1</sup>	
Helium	2	↑↓				1s <sup>2</sup>	
Lithium	3	↑↓	↑			1s <sup>2</sup> 2s <sup>1</sup>	
Beryllium	4	↑↓	↑↓			1s <sup>2</sup> 2s <sup>2</sup>	
Boron	5	↑↓	↑↓	↑		1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>1</sup>	
Carbon	6	↑↓	↑↓	↑	↑	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>2</sup>	
Nitrogen	7	↑↓	↑↓	↑	↑	↑	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>3</sup>
Oxygen	8	↑↓	↑↓	↑↓	↑	↑	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>4</sup>
Fluorine	9	↑↓	↑↓	↑↓	↑↓	↑	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>5</sup>
Neon	10	↑↓	↑↓	↑↓	↑↓	↑↓	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup>

185- What would be the proper noble gas notation for oxygen?

- A) [Ne]2p<sup>4</sup>
- B) [Ne]2p<sup>1</sup>
- C) [He]2p<sup>4</sup>
- D) [He]2p<sup>1</sup>

186- Given the electron dot structure, what further information is required to find the identity of element X?

- A) the number of valence electrons
- B) the period in which the element is found
- C) the number of neutrons
- D) the electric charge



Name: .....

9\ .....

For each item in Column A, write the letter of the matching item in Column B.

Column A

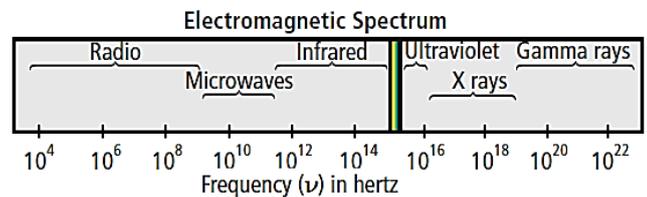
Column B

- |  |  |
|--|--|
| <p>_____ 1- The shortest distance between equivalent points on a continuous wave.</p> <p>_____ 2- Electrons in the atom's outermost orbitals</p> <p>_____ 3- Each electron occupies the lowest energy orbital available.</p> <p>_____ 4- The number of waves that pass a given point per second.</p> <p>_____ 5- Three-dimensional region around the nucleus predicted by the wave function.</p> <p>_____ 6- Single electrons with the same spin must occupy each equal-energy orbital before additional electrons with opposite spins can occupy the same orbitals.</p> <p>_____ 7- The minimum amount of energy that can be gained or lost by an atom.</p> <p>_____ 8- The set of frequencies of the EM waves emitted by atoms of the element.</p> <p>_____ 9- The arrangement of electrons in an atom</p> <p>_____ 10- A maximum of two electrons of opposite spins can occupy a single atomic orbital.</p> | <p>a- Frequency</p> <p>b- Aufbau principle</p> <p>c- Valence electrons</p> <p>d- Wavelength</p> <p>e- Atomic emission spectrum</p> <p>f- Atomic orbital</p> <p>g- Electron configuration</p> <p>h- Hund's rule</p> <p>i- Pauli exclusion principle</p> <p>j- Quantum</p> |
|--|--|

Use the following data and the figure to answer questions 11-14. ( $c=3 \times 10^8 \text{ m/s}$ )

The wavelength of an EM wave is  $6.52 \mu\text{m}$ , find:

11- The wavelength in m ( $1 \mu\text{m} = 10^{-6} \text{ m}$ ):



12- The frequency of the wave:

13- To which part of the EM spectrum does this wave belong?

14- Find the energy of the photon of this type of radiation

Find the energy of a microwave photon that has a frequency of 11.5 GHz ( $1 \text{ GHz} = 10^9 \text{ Hz}$ ).

15- (frequency in Hz) \_\_\_\_\_

16- (Photon energy) \_\_\_\_\_

Use the diagram to answer questions 17-21

17- which wave has the lowest frequency? \_\_\_\_\_

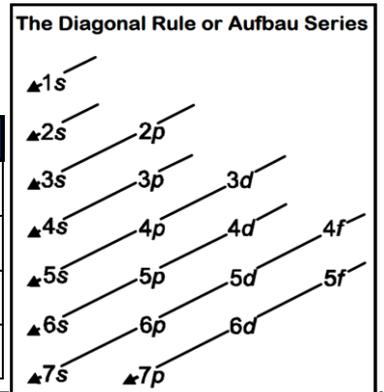
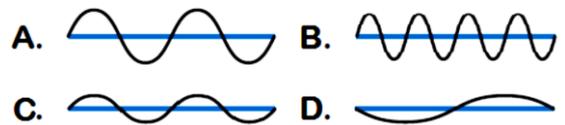
Greatest frequency? \_\_\_\_\_

18- Which wave has the shortest wavelength? \_\_\_\_\_ longest wavelength? \_\_\_\_\_

19- Which wave has the smallest amplitude? \_\_\_\_\_ largest amplitude? \_\_\_\_\_

20- Which wave has the lowest energy? \_\_\_\_\_ greatest energy? \_\_\_\_\_

21- Which two waves have the same frequency? \_\_\_\_\_ and \_\_\_\_\_



Complete the following tables:

N	Symbol	Number of Electrons	Electron configuration
	Mg	12	$1s^2 2s^2 2p^6 3s^2$
22	Rb		
23	V		
24	K		

N	Symbol	Number of Electrons	Electron configuration
25	Cl		<input type="checkbox"/> 1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d
26	Mn		<input type="checkbox"/> 1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d
27	Ar		<input type="checkbox"/> 1s <input type="checkbox"/> 2s <input type="checkbox"/> 2p <input type="checkbox"/> 3s <input type="checkbox"/> 3p <input type="checkbox"/> 4s <input type="checkbox"/> 3d

	Name	Number of Electrons	Electron configuration	Nobel-gas configuration
28	Magnesium		$1s^2 2s^2 2p^6 3s^2$	
29			$1s^2 2s^2 2p^6 3s^2 3p^3$	[Ne] $3s^2 3p^3$
30			$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$	[Ar] $4s^2 3d^3$
31	Germanium		$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$	
32	Iodine		$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^5$	
33				[Kr] $5s^2 4d^9$

	Electron configuration	Rule violated	Explanation
	$\uparrow\downarrow$ 1s $\uparrow\downarrow$ 2s $\uparrow\downarrow$ 2p	Hunds Rule	In equal energy orbitals same spin first
34	$\uparrow\downarrow$ 1s $\uparrow\downarrow$ 2s $\uparrow\downarrow$ 2p $\uparrow\downarrow$ 3s $\uparrow\downarrow$ 3p		
35	$\uparrow\downarrow$ 1s $\uparrow\downarrow$ 2s $\uparrow\downarrow$ 2p $\uparrow\downarrow$ 3s $\uparrow\downarrow$ 3p		
36	$\uparrow\downarrow$ 1s $\uparrow\downarrow$ 2s $\uparrow\downarrow$ 2p $\uparrow\downarrow$ 3s $\uparrow\downarrow$ 3p $\uparrow\downarrow$ 4s $\uparrow\downarrow$ 3d		

	Element	Number of valence electrons	Dot-structure
	Neon	8	
37	Gallium		
38	Bromine		
39	Calcium		
40	Silicon		