Name _____ per___ due date_____ mail box _____

RADIOACTIVE ISOTOPE

Background reading - Consider how scientists determine the age of things.

Many of the earth's geological processes such as the eruption of volcanoes or earthquakes, the drifting of the continents, and erosion of land, occur at irregular intervals. There can be spurts of activity and then long durations of inactivity. These processes often reveal *relative time* which, can help provide science with a timeline for the age of the earth but not *absolute time*. Geologists that study the age of the earth and its rock layers need ways to accurately or *absolutely* determine their age. Likewise, in biology, biologists need ways to actively date ancient samples of human, animal or plant remains. The answer to how science can accurately date and determine the age of things, is found within the realm of physics. Within the atom is highly dependable and very accurate clock. This clock is atomic decay or the rate of radioactive decay an d it is very predictable. For the remains of plants and animals' the decay of carbon into nitrogen or *carbon dating* can be used to determine how old once living remains are. As for the age of the earth, uranium-lead dating, the radioactive decay of uranium into lead is used. Based on the very old zircon rock from Australia we know that the Earth is at least 4.374 billion years old.

Testing radioactive minerals in rocks best determines absolute time. Radioactive decay goes on like clockwork at an even and continuous pace. The nuclei of radioactive atoms break down releasing particles and radiation. Finally, the radioactive element changes into a stable new element. The radioactive element is called the parent, and the stable new element is called the daughter.

The rate of radioactive decay is measured by half-life. Half-life is the time it takes for the atoms of a parent element to change into atoms of the daughter element. Consider the element radium 226, which has a half-life of 1,622 years. What happens to 10 grams of radium after 1,622 years? Five grams of radium remain, and five grams will have changed to lead, hence the *half-life* is 1,622 years.

Vocabulary-

Word bank: Radioactive Decay - Half-life - Isotopes -

1._____ each of two or more forms of the same element that contain equal numbers of protons but different numbers of neutrons in their nuclei, and hence differ in relative atomic mass, but not in chemical properties.

2._____ the amount of time taken for the radioactive decay of a specific isotope to fall to half its original value.

3._____ the emission of radiation specifically in the form of particles (protons or neutrons) from the nucleus of an atom. **This reduces the atomic mass and or atomic number** and potentially even the elements identity.

BELOW are 3 naturally occurring isotopes of Carbon.

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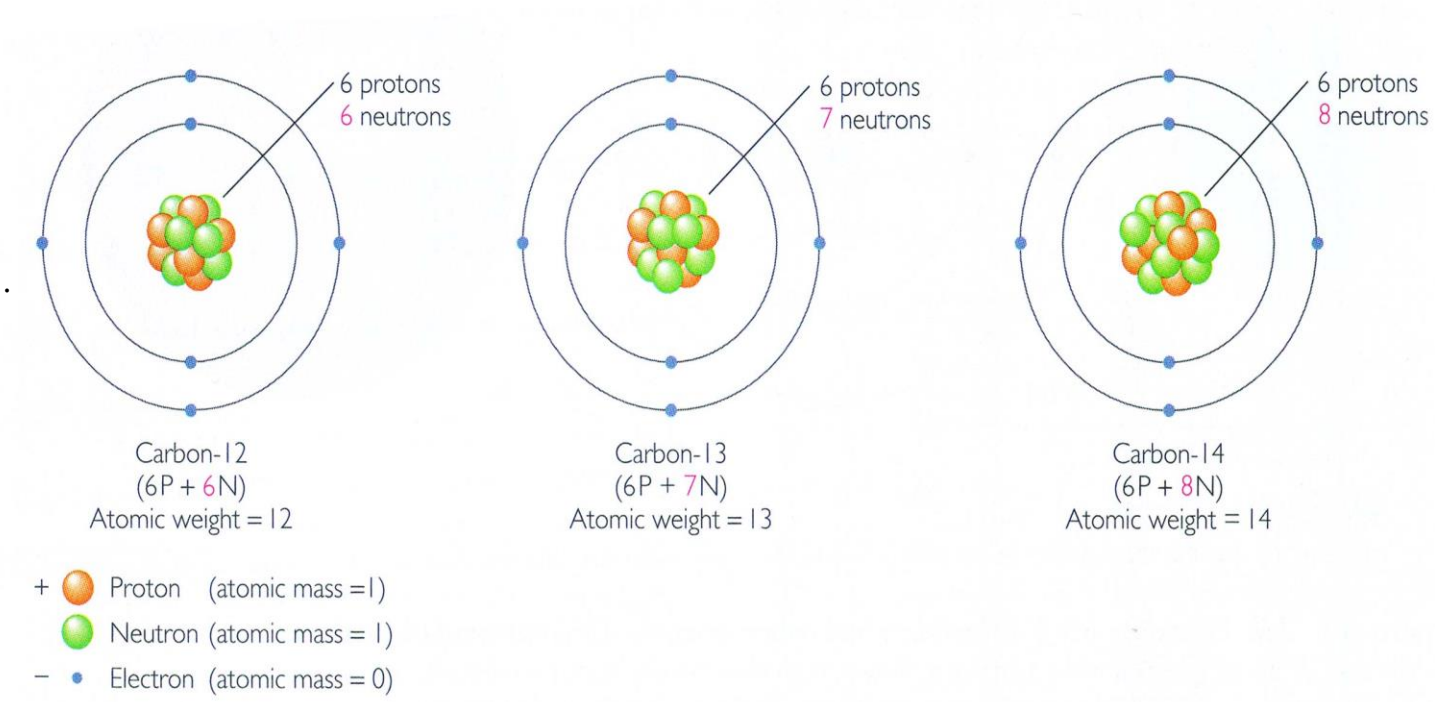

FIGURE 2.3 These three carbon isotopes all have the same number of protons and thus the same atomic number, 6. Their atomic masses differ, however, because they have slightly different numbers of neutrons. The atomic mass of any element is the average of the weighted sum of the atomic masses of its various isotopes. One isotope of an element—for example, carbon-12—is far more abundant than the others because natural processes favor that particular isotope.

4. Base your answers (1-3) on the above diagram. Which isotope of carbon has the greatest atomic mass?

A. Carbon 12
B. Carbon 13
C. Carbon 14
D. Carbon 15

5. Which atomic particle gives carbon or any atom their identity? (What makes carbon, carbon?)

A. protons
B. neutron
C. electrons
D. quarks and leptons

6. Which atomic particle causes this isotope's mass or "weight" to vary from the norm?

A. protons
B. neutron
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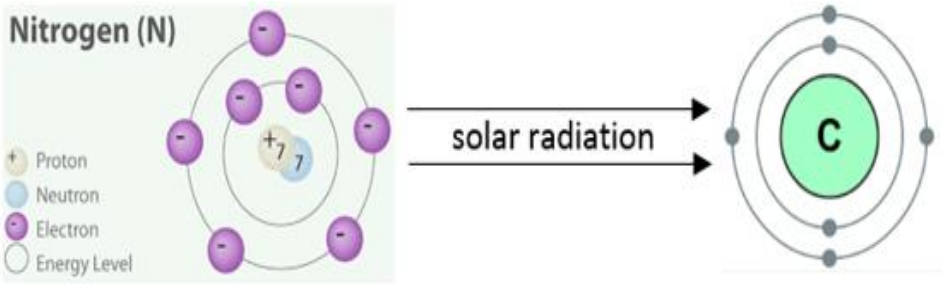
D. quarks and leptons

Where carbon-14 comes from:

7. Carbon is a common component of our atmosphere bound to oxygen in the form of carbon-dioxide or carbon- monoxide. Radiation from the sun interacts with these atmospheric gases and others the most of which is nitrogen. Nitrogen when bombarded by the sun's radiations can turn into carbon-14. Most of the carbon in our atmosphere is carbon-12. Carbon-14 is a small percentage of the atmosphere that has remained relatively consistent throughout our planet's recent history. The ratio of carbon-14 is changing however, due to carbon inputs to atmosphere from the combustion of fossil fuels.



Select the best answer based on your knowledge and the above passage.

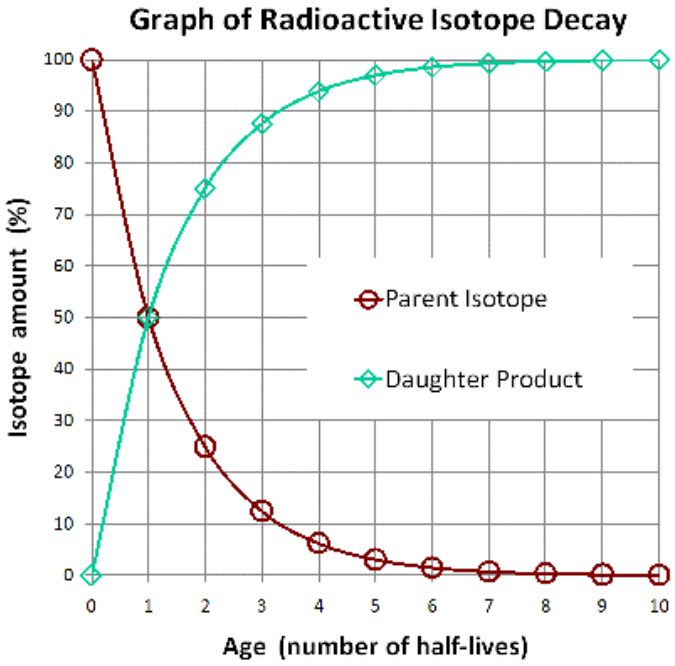
A. Carbon-14 comes from carbon-12

B. Carbon-14 is a product of solar radiation in our atmosphere and comes from nitrogen.

C. Carbon-14 comes from Santa Clause

D. Carbon-14 has 7 electrons which makes it an isotope.

Look at the graph to the right. The parent isotope represents unchanged atoms of carbon. The daughter product represents an increasing number of nitrogen atoms over time (half-lives).



8a. Did the number *daughter isotope* atoms increase or decrease over time (half-lives). Daughter Product

Circle one → **increase** or **decrease**

8b. Did the number *parent isotope* atoms increase or decrease over time (half-lives). Parent Isotope

Circle one → **increase** or **decrease**

Essay - What do these two lines (from the graph) represent? How do you know this? Discuss and use at least **2** of the following vocabulary words: **radioactive, isotope, parent and daughter isotope, half-life, radioactive – decay**

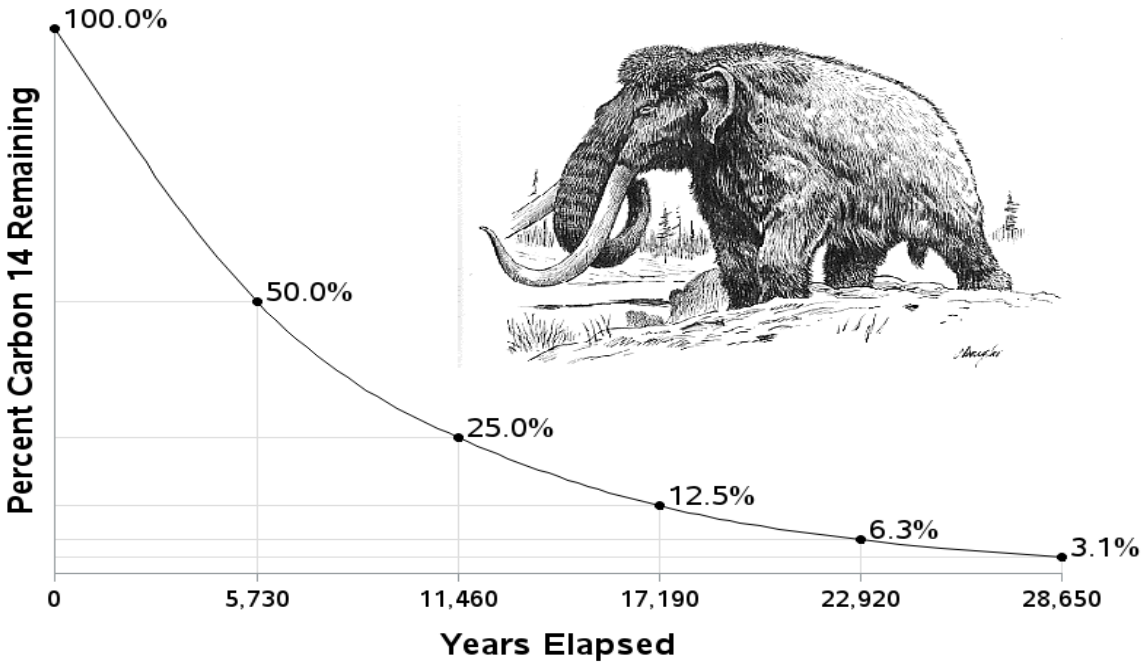
WRITE ON ANSWER KEY

_____

_____

_____

Rate of Decay for Carbon 14



Carbon-14 has a *half-life* of 5730 years. This means that statistically speaking if you had 100 carbon-14 atoms about ½ will have decayed into the more stable parent element nitrogen-14, what they were originally 5730yrs. Base your answers to the following, on the above diagram. Imagine these atoms are in the bones of this mastodon found at a paleontologist's dig site.

9. About half or 50% remain unchanged, indicating the sample age to be about what age?

A. 5,730 yrs.
B. 11,460 yrs.
C. 17,190 yrs.
D. 22,920 yrs.

10. About 3/4 or 75% have changed, meaning they have radioactively decayed into the daughter element nitrogen and 25% of the C-14 remains. What is the age of the sample?

A. 5,730 yrs.
B. 11,460 yrs.
C. 17,190 yrs.
D. 22,920 yrs.

11. The paleontologist estimates based on ratio samples of carbon-14 to nitrogen-14 from the animal's bones that about 5 half-lives have elapsed since this animal died. What is the approximate age of the remains?

A. 11,460 yrs.
B. 17,190 yrs.
C. 22,920 yrs.
D. 28,650 yrs.

Name _____ per___ due date_____ mail box _____

Multiple Choice – ANSWER SHEET fill it along with a short written response to question essay

TEAR OFF THIS PAGE – RECORD YOUR OWN ANSWERS AND PUT INTO IN BOX

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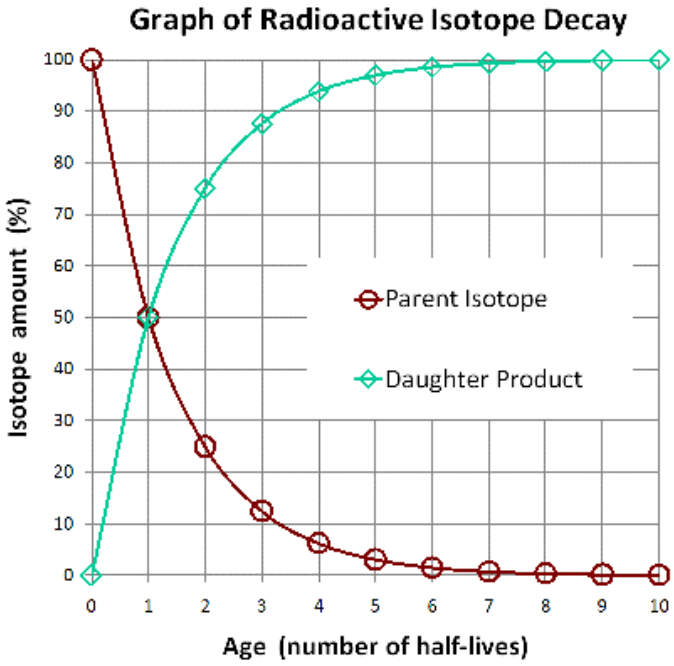

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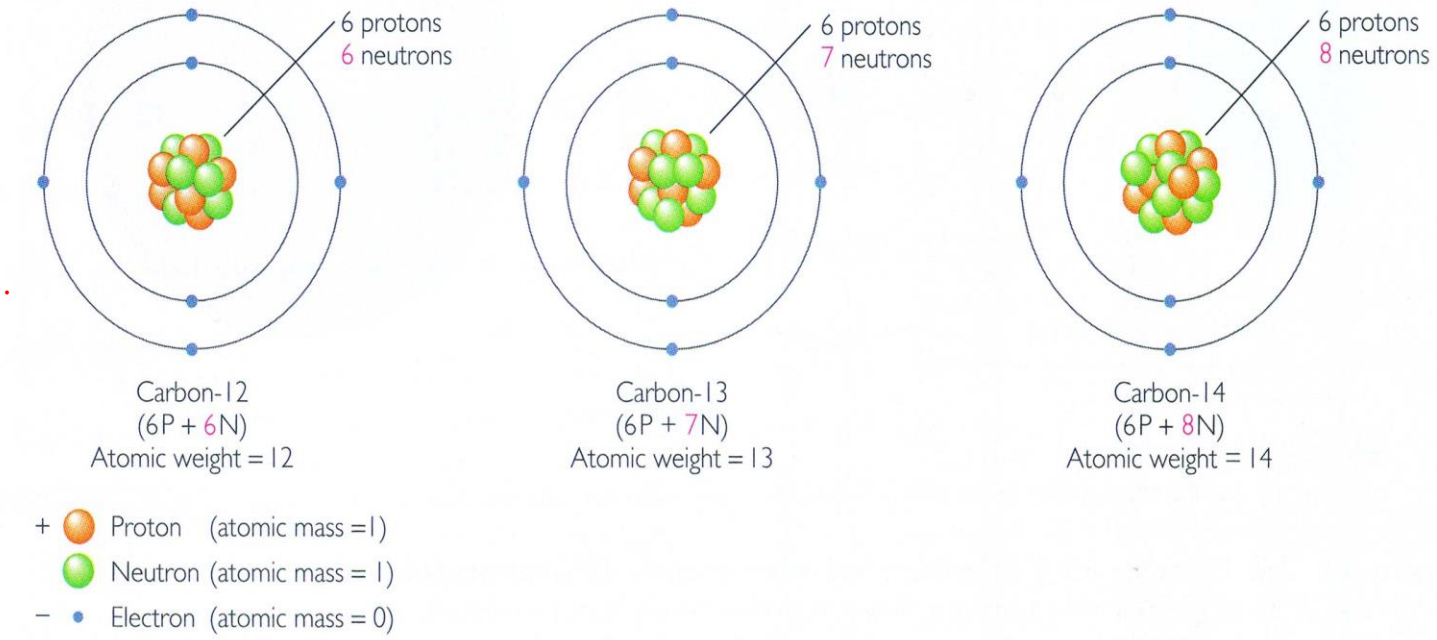

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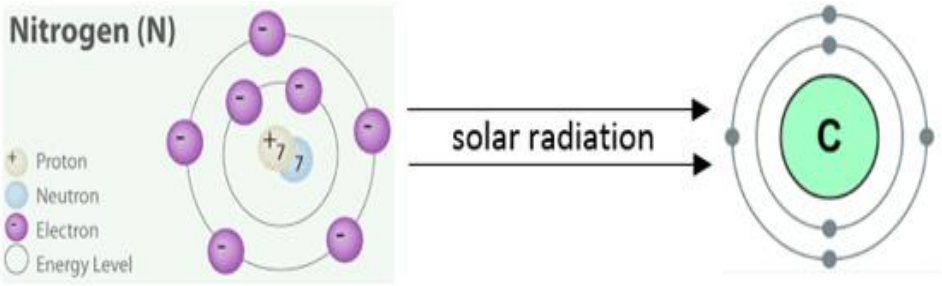

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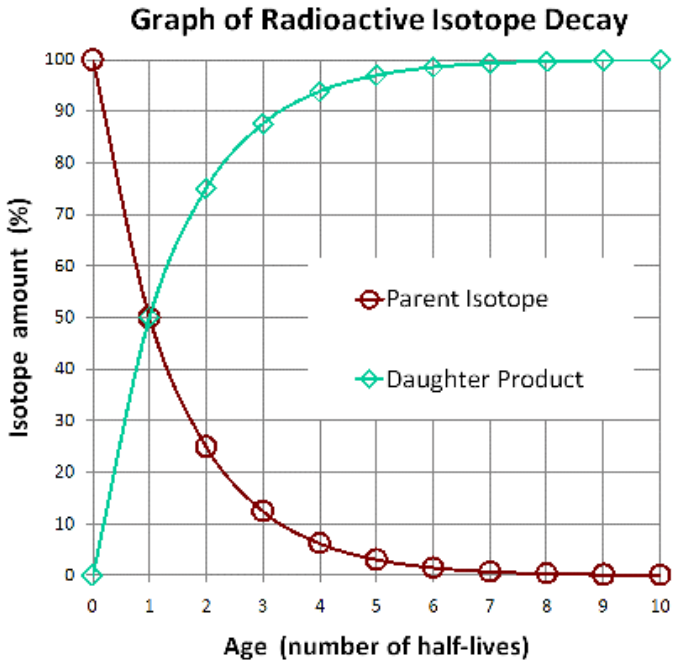

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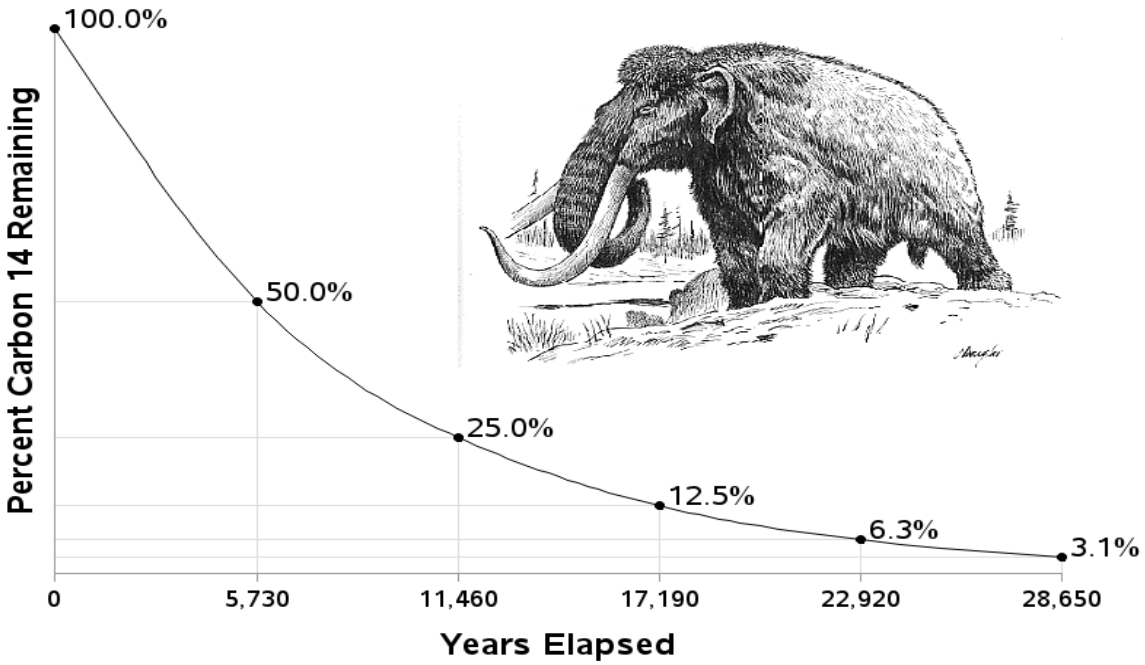

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A. 28,650 yrs.
B. 22,920 yrs.
C. 17,190 yrs.
D. 11,460 yrs.

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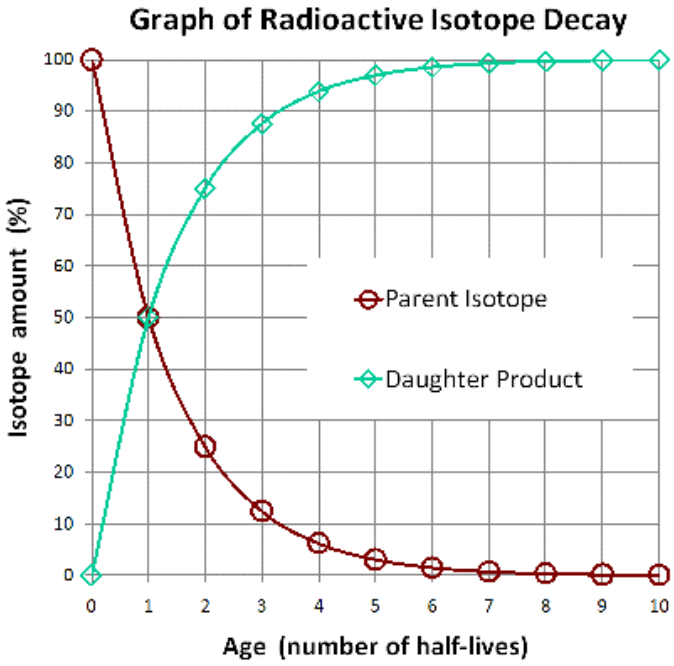

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WRITE ON ANSWER KEY

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Matching

Write the letter on the line that below that best describes the terms.

Vocabulary	Definition
_____**24.** Atomic Mass	**A.** the number of protons in an atom
_____**25.** Nucleus	**B.** Subatomic particle with a negative charge
_____**26.** Atomic Number	**C.** Center of an atom
_____**27.** Electrons	**D.** Subatomic particle with a positive charge
_____**28.** Neutrons	**E.** The number of neutrons plus the number of neutron in an atom
_____**29.** Protons	**F.** Subatomic particle with a neutral charge

30-33.Directions: The chemical symbol of four different elements are listed below.

Cd Cu Br P

Write the symbol of these four elements in the appropriate box in the chart below to indicate whether the element is a metal on a nonmetal.

Element Classification	Element Symbol
Metals	
Nonmetals	

34. Which group in the Periodic Table is the Noble Gases located?

_____

Directions: Draw a Bohr Model of the elements below. Show all your work

Element: 25 Mg 54.9380	Bohr Model
Protons: Neutrons: Electrons: Atomic #: Atomic Mass:	

Element: 16 S 32.059	Bohr Model
Protons: Neutrons: Electrons: Atomic #: Atomic Mass:	

Directions: Draw the Lewis Structures

Ne	**Be**

B = Solids Hg = Liquids Kr = Gases Pm = Not found in nature

1												13	14	15	16	17	18
1 H 1.00794	2																2 He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050	3	4	5	6	7	8	9	10	11	12	13 Al 26.581538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6534	29 Cu 63.545	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.504	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 196.56655	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	71 Lu 174.967	72 Hf 178.49	73 Ta 180.94.79	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.56655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.58038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	103 Lr (262)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Cn (277)	113 Uut (277)	114 Uuq (277)	115 Uup (277)	116 Uuh (277)		118 Uuo (277)

												57 La 138.9055	58 Ce 140.116	59 Pr 140.50765	60 Nd 144.24	61 Pm (145)	62 Sm 150.36
												89 Ac 232.0381	90 Th 232.0381	91 Pa 231.035888	92 U 238.0289	93 Np (237)	94 Pu (244)

63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04
95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)

Properties of Metals	**Properties of Nonmetals**	**Properties of Metalloids**