

## NUCLEAR DECAY & HALF-LIFE

**INSTRUCTIONS:**

1. Be careful of your spelling. Answer in ALL CAPS (CAPSLOCK)!
2. Isotopes must be in "ELEMENT-NUMBER" format.
3. Numbers **MUST** be in numerical form e.g., 1, 40... not one, forty

Ps. There is a periodic table attached for your perusal. 

**Multiple Choice.**

## 1. What is Half-life?

- The amount of time it takes for some of the nuclei in a sample of the isotope to decay
- The amount of time it takes for half the electrons in a sample of the isotope to decay
- The amount of time it takes for half the nuclei in a sample of the isotope to decay
- the amount of time it takes to double the nuclei in a sample of the isotope to decay

2. Which best describes an isotope?

- atoms of the same element with the same mass
- atoms of different elements with the same mass
- atoms of the same element with a different number of neutrons
- atoms of different elements with different number of neutrons

### 3. What is emitted during Beta Radiation?

a high-energy electron	a high-energy proton
a high-energy neutron	2 protons & 2 Neutrons

4. What type of decay is evident in the nuclear reaction shown?  ${}^9_4\text{Be} + {}^1_1\text{H} \rightarrow {}^6_3\text{Li} + {}^4_2\text{He}$

5. An alpha particle is a

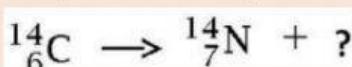
Be-4 nucleus      He-4 nucleus      C-12 nucleus      C-4 nucleus

**II. Fill in the blanks.**

1. How many protons are present in one atom of carbon?
2. What does the "12" in carbon-12 represent?
3. Of the 3 types of radioactive decay, which is the most dangerous?
4. Which type of nuclear radiation is being emitted here? 

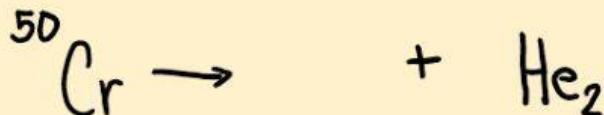


5. What particle completes this reaction?



### III. Complete the equation.

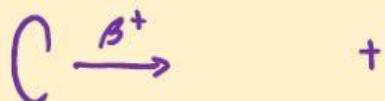
1. If Chromium-50 undergoes alpha decay, what isotope will result?



2. When Caesium-137 undergoes radioactive decay, it emits a beta particle. What isotope will result?



3. When Carbon-14 undergoes positron emission, what isotope will result?



### IV. Problem Solving. Write the solution in your notebook. Attach photo in Google Classroom.

1. Barium-122 has a half-life of 3 minutes. A fresh sample weighing 500-g was obtained. If it takes 30-minutes to set up an experiment using Barium-122, how much will be left when the experiment begins?

2. Sodium-24 has a half-life of 15-hours. A 7-kg sample was left sitting in the laboratory reducing the amount to 244-mg. How long was it left for?

3. A container of element X-131 weighs 3000-g, in 30 days only 2.93-g was left. Determine the half-life of this element.

<b>1</b> <b>IA</b> <b>H</b> Hydrogen 100% 1	<b>2</b> <b>IIA</b> <b>Be</b> Beryllium 93% 2	<p>Atomic Number → <b>1</b>      ← Symbol            Name → <b>H</b>      ← Atomic Weight            Electron per shell →      ← Unknown chemical properties</p> <p>State of matter (color of name):  <b>Gas</b>   <b>Liquid</b>   <b>Solid</b>   <b>Unknown</b></p> <p>Subcategory in the metal-metalloid-nonmetal trend (color of background):  <b>Alkali metals</b>   <b>Alkaline earth metals</b>   <b>Transition metals</b>   <b>Post-transition metals</b>   <b>Actinides</b>   <b>Post-actinides</b>   <b>Metalloids</b>   <b>Reactive nonmetals</b>   <b>Noble gases</b></p>										<b>18</b> <b>VIIA</b> <b>He</b> Helium 4.9200 2						
<b>3</b> <b>Li</b> Lithium 7.48% 3	<b>4</b> <b>Mg</b> Magnesium 12.00% 12	<b>5</b> <b>Sc</b> Scandium 44.93200 21	<b>6</b> <b>Ti</b> Titanium 45.967 22	<b>7</b> <b>V</b> Vanadium 50.942 23	<b>8</b> <b>Cr</b> Chromium 51.996 24	<b>9</b> <b>Mn</b> Manganese 54.938 25	<b>10</b> <b>Fe</b> Iron 55.845 26	<b>11</b> <b>Co</b> Cobalt 58.932 27	<b>12</b> <b>Ni</b> Nickel 58.693 28	<b>13</b> <b>Cu</b> Copper 63.547 29	<b>14</b> <b>Zn</b> Zinc 65.402 30	<b>15</b> <b>Al</b> Aluminum 26.982 31	<b>16</b> <b>Si</b> Silicon 28.085 32	<b>17</b> <b>O</b> Oxygen 15.999 3	<b>18</b> <b>F</b> Fluorine 18.998 9	<b>19</b> <b>Ne</b> Neon 20.180 10		
<b>11</b> <b>Na</b> Sodium 22.9897 11	<b>12</b> <b>Mg</b> Magnesium 12.00% 12	<b>20</b> <b>Ca</b> Calcium 19.99244 20	<b>21</b> <b>Sc</b> Scandium 44.93200 21	<b>22</b> <b>Ti</b> Titanium 45.967 22	<b>23</b> <b>V</b> Vanadium 50.942 23	<b>24</b> <b>Cr</b> Chromium 51.996 24	<b>25</b> <b>Mn</b> Manganese 54.938 25	<b>26</b> <b>Fe</b> Iron 55.845 26	<b>27</b> <b>Co</b> Cobalt 58.932 27	<b>28</b> <b>Ni</b> Nickel 58.693 28	<b>29</b> <b>Cu</b> Copper 63.547 29	<b>30</b> <b>Zn</b> Zinc 65.402 30	<b>31</b> <b>Al</b> Aluminum 26.982 31	<b>32</b> <b>Si</b> Silicon 28.085 32	<b>33</b> <b>O</b> Oxygen 15.999 3	<b>34</b> <b>F</b> Fluorine 18.998 9	<b>35</b> <b>Ne</b> Neon 20.180 10	
<b>19</b> <b>K</b> Potassium 39.0984 19	<b>20</b> <b>Ca</b> Calcium 19.99244 20	<b>21</b> <b>Sc</b> Scandium 44.93200 21	<b>22</b> <b>Ti</b> Titanium 45.967 22	<b>23</b> <b>V</b> Vanadium 50.942 23	<b>24</b> <b>Cr</b> Chromium 51.996 24	<b>25</b> <b>Mn</b> Manganese 54.938 25	<b>26</b> <b>Fe</b> Iron 55.845 26	<b>27</b> <b>Co</b> Cobalt 58.932 27	<b>28</b> <b>Ni</b> Nickel 58.693 28	<b>29</b> <b>Cu</b> Copper 63.547 29	<b>30</b> <b>Zn</b> Zinc 65.402 30	<b>31</b> <b>Al</b> Aluminum 26.982 31	<b>32</b> <b>Si</b> Silicon 28.085 32	<b>33</b> <b>O</b> Oxygen 15.999 3	<b>34</b> <b>F</b> Fluorine 18.998 9	<b>35</b> <b>Ne</b> Neon 20.180 10		
<b>27</b> <b>Rb</b> Rubidium 61.446 27	<b>28</b> <b>Sr</b> Strontium 65.452 28	<b>29</b> <b>Y</b> Yttrium 88.91864 39	<b>30</b> <b>Zr</b> Zirconium 89.98232 40	<b>31</b> <b>Nb</b> Niobium 89.98232 41	<b>32</b> <b>Mo</b> Molybdenum 95.941 42	<b>33</b> <b>Tc</b> Technetium 98.00 43	<b>34</b> <b>Ru</b> Ruthenium 101.07 44	<b>35</b> <b>Rh</b> Rhodium 102.91 45	<b>36</b> <b>Pd</b> Palladium 106.42 46	<b>37</b> <b>Ag</b> Silver 107.87 47	<b>38</b> <b>Cd</b> Cadmium 112.49 48	<b>39</b> <b>In</b> Indium 113.42 49	<b>40</b> <b>Sn</b> Tin 118.71 50	<b>41</b> <b>Ge</b> Germanium 112.40 51	<b>42</b> <b>As</b> Arsenic 117.80 52	<b>43</b> <b>Se</b> Selenium 118.70 53	<b>44</b> <b>Br</b> Bromine 119.88 54	<b>45</b> <b>Kr</b> Krypton 131.90 55
<b>55</b> <b>Cs</b> Cesium 123.550465 55	<b>56</b> <b>Ba</b> Barium 137.32651 56	<b>57-71</b> <b>Lanthanides</b>	<b>72</b> <b>Hf</b> Hafnium 178.49 72	<b>73</b> <b>Ta</b> Tantalum 180.947 73	<b>74</b> <b>W</b> Tungsten 183.84 74	<b>75</b> <b>Re</b> Rhenium 186.21 75	<b>76</b> <b>Os</b> Osmium 190.23 76	<b>77</b> <b>Ir</b> Iridium 191.23 77	<b>78</b> <b>Pt</b> Platinum 191.09 78	<b>79</b> <b>Au</b> Gold 196.97 79	<b>80</b> <b>Hg</b> Mercury 200.53 80	<b>81</b> <b>Tl</b> Thallium 204.40 81	<b>82</b> <b>Pb</b> Lead 207.2 82	<b>83</b> <b>Bi</b> Bismuth 208.9 83	<b>84</b> <b>Po</b> Polonium 209.0 84	<b>85</b> <b>At</b> Astatine (210) (85)	<b>86</b> <b>Rn</b> Radium (226) (86)	
<b>87</b> <b>Fr</b> Francium 223 87	<b>88</b> <b>Ra</b> Radium 226 88	<b>89-103</b> <b>Actinides</b>	<b>104</b> <b>Rf</b> Rutherfordium (261)	<b>105</b> <b>Db</b> Dubnium (262)	<b>106</b> <b>Sg</b> Seaborgium (263)	<b>107</b> <b>Bh</b> Bhertium (264)	<b>108</b> <b>Hs</b> Hassium (265)	<b>109</b> <b>Mt</b> Meitnerium (266)	<b>110</b> <b>Ds</b> Darmstadtium (268)	<b>111</b> <b>Rg</b> Roentgenium (272)	<b>112</b> <b>Cn</b> Copernicium (285)	<b>113</b> <b>Nh</b> Nhastium (286)	<b>114</b> <b>Tl</b> Tlithium (294)	<b>115</b> <b>Pb</b> Plutonium (299)	<b>116</b> <b>Lv</b> Livermorium (295)	<b>117</b> <b>Ts</b> Tennessine (296)	<b>118</b> <b>Og</b> Oganesson (298)	
<b>57</b> <b>La</b> Lanthanum 138.91 57	<b>58</b> <b>Ce</b> Cerium 140.11 58	<b>59</b> <b>Pr</b> Praseodymium (141)	<b>60</b> <b>Nd</b> Neodymium 144.24 60	<b>61</b> <b>Pm</b> Promethium (145)	<b>62</b> <b>Sm</b> Samarium 150.36 62	<b>63</b> <b>Eu</b> Europium 151.96 63	<b>64</b> <b>Gd</b> Gadolinium 157.25 64	<b>65</b> <b>Tb</b> Terbium 158.93 65	<b>66</b> <b>Dy</b> Dysprosium 162.50 66	<b>67</b> <b>Ho</b> Holmium 164.93 67	<b>68</b> <b>Er</b> Erbium 167.26 68	<b>69</b> <b>Tm</b> Thulium 168.93 69	<b>70</b> <b>Yb</b> Ytterbium 173.05 70	<b>71</b> <b>Lu</b> Lutetium 174.91 71				
<b>89</b> <b>Ac</b> Actinium (227)	<b>90</b> <b>Th</b> Thorium (232)	<b>91</b> <b>Pa</b> Protactinium (231)	<b>92</b> <b>U</b> Uranium (238)	<b>93</b> <b>Np</b> Neptunium (237)	<b>94</b> <b>Pu</b> Plutonium (239)	<b>95</b> <b>Am</b> Americium (243)	<b>96</b> <b>Cm</b> Curium (247)	<b>97</b> <b>Bk</b> Berkelium (247)	<b>98</b> <b>Cf</b> Californium (252)	<b>99</b> <b>Es</b> Einsteinium (257)	<b>100</b> <b>Fm</b> Fermium (252)	<b>101</b> <b>Md</b> Mendelevium (256)	<b>102</b> <b>No</b> Neptunium (259)	<b>103</b> <b>Lr</b> Lawrencium (266)				