Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_ \_\_\_\_\_\_ / 30

**Key**

Half-Life Math

1. An isotope of cesium (cesium-137) has a half-life of 30 years. If 1.0 gram of cesium-137 disintegrates over a period of 90 years, how many grams of cesium-137 would remain?

 Cesium-137 half-life = 30 years

 Start with 1g

 1st 30 years = .5g

 2nd 30 years = .25g

 3rd 30 years = .125g

1. Actinium-226 has a half-life of 29 hours. If 100 milligrams of actinium-226 disintegrates over a period of 58 hours, how many milligrams of actinium-226 will remain?

 Actinium-226 half-life = 29 hours

 Start with 100mg

 1st 29 hours = 50mg

 2nd 29 hours = 25mg

1. Sodium-25 was to be used in an experiment, but it took 3.0 minutes to get the sodium from the reactor to the laboratory. If 5.0 milligrams of sodium-25 was removed from the reactor, how many milligrams of sodium-25 were placed in the reaction vessel 3.0 minutes later, if the half-life of sodium-25 is 60 seconds?

 Sodium-25 half-life = 1 minute

 Start with 5 mg

 Takes 3 half-lives to get to laboratory

 1st minute = 2.5mg

 2nd minute = 1.25mg

 3rd minute = .625mg

1. The half-life of isotope X is 2.0 years. How many years would it take a 4.0 milligram sample of X to decay and have only 0.50 milligrams of it remain?

 X half-life = 2 yrs

 Start = 4.0 mg

 1st 2 years = 2.0mg

 2nd 2 years = 1.0mg

 3rd 2 years = .5mg

 3 half-lives x 2 years = 6 years

1. Selenium-83 has a half-life of 25.0 minutes. How many minutes would it take for a 10.0 milligram sample to decay and have only 1.5 milligrams of it remain?

 Selenium-83 half-life = 25 minutes

 1st 25 minutes = 5mg

 2nd 25 minutes = 2.5mg

 3rd 25 minutes = 1.25

 How many grams are decaying per minute?

 From 2nd half-life to 3rd half-life: 2.5 – 1.25 = 1.25g per 25 minutes

 1.25g / 25 minutes = .05g/minute

 1.5g – 1.25g = .25g

 .25g / .05g = 5 minutes; 25 minutes – 5 minutes = 20 minutes

 25 minutes + 25 minutes + 20 minutes = 70 minutes

1. The half-life of Polonium-218 is 3.0 minutes. How much of a 2.0 gram sample remains after 15 minutes? Suppose you wanted to buy some of this isotope and it required half an hour for it to reach you. How much should you order if you need to use 0.10 grams of this material?

Polonium-218 half-life = 3 minutes

15 minutes has 5 half-lives in it.

Starting sample = 2g

1st 3 minutes = 1g

2nd 3 minutes = .5g

3rd 3 minutes = .25g

4th 3 minutes = .125g

5th 3 minutes = .0625g

Half hour = 10 half-lives

Ending with 0.10 grams

1st previous half-life (3 min) = .2g

2nd previous half-life (6 min) = .4g

3rd previous half-life (9 min) = .8g

4th previous half-life (12 min) = 1.6g

5th previous half-life (15 min) = 3.2g

6th previous half-life (18 min) = 6.4g

7th previous half-life (21 min) = 12.8g

8th previous half-life (24 min) = 25.6g

9th previous half-life (27 min) = 51.2g

10th previous half-life (30 min) = 102.4g