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Date: _____ Period: _____

Half-Life Problems

1. The half-life of iodine-131 is 8.1 days. How long will it take for three-fourths of a sample of iodine-131 to decay?

16.2 days

| HL | T | A |
|----|------|-----|
| 0 | 0 | 100 |
| 1 | 8.1 | 1/2 |
| 2 | 16.2 | 1/4 |

1/4 is left over
3/4 has decayed.

2. Radon-222 is a radioactive gas with a half-life of 3.82 days. How long would it take for seven-eighths of a sample of radon-222 to decay?

11.46 days

| HL | T | A |
|----|--------|-----|
| 0 | 0 | 100 |
| 1 | 3.82d | 1/2 |
| 2 | 7.64d | 1/4 |
| 3 | 11.46d | 1/8 |

7/8 decayed
1/8 is left over

3. Calculate the time required for three-fourths of a sample of cesium-138 to decay if its half-life is 32.2 minutes.

64.4 m

| HL | T | A |
|----|-------|-----|
| 0 | 0 | 100 |
| 1 | 32.2m | 1/2 |
| 2 | 64.4m | 1/4 |

3/4 has decayed
1/4 is left over

4. A sample of strontium-90 is found to have decayed to one-eighth of its original amount after 87.3 years. What is the half-life of strontium-90?

$$\frac{87.3 \text{ yrs}}{3 \text{ hl}} = 29.1 \text{ yrs}$$

| HL | T | A |
|----|----------|-----|
| 0 | 0 | 100 |
| 1 | | 1/2 |
| 2 | | 1/4 |
| 3 | 87.3 yrs | 1/8 |

5. A sample of francium-212 will decay to one-sixteenth its original amount after 80 minutes. What is the half-life of francium-212?

$$\frac{80 \text{ mins}}{4 \text{ hl}} = 20 \text{ minutes}$$

| HL | T | A |
|----|----|------|
| 0 | 0 | 100 |
| 1 | | 1/2 |
| 2 | | 1/4 |
| 3 | | 1/8 |
| 4 | 80 | 1/16 |

6. A sample of radon-222 decays to one-fourth its original amount after 7.684 days. What is the half-life of radon-222?

$$\frac{7.684 \text{ day}}{2 \text{ hl}} = 3.842 \text{ d}$$

| HL | T | A |
|----|---------|-----|
| 0 | 0 | 100 |
| 1 | | 1/2 |
| 2 | 7.684 d | 1/4 |

7. What is the half-life of a 100 g sample of nitrogen-16 that decays to 12.5 g of nitrogen-16 in 21.6 s?

$$\frac{21.6 \text{ s}}{3 \text{ hl}} = 7.2 \text{ s}$$

| HL | T | A |
|----|--------|-------|
| 0 | 0 | 100g |
| 1 | | 50g |
| 2 | | 25g |
| 3 | 21.6 s | 12.5g |

8. Uranium-238 decays very slowly, with a half-life of 4.47 billion years. What fraction of a sample of uranium-238 would remain after 13.41 billion years?

| HL | T | A |
|----|-------|-----|
| 0 | 0 | 100 |
| 1 | 4.476 | 1/2 |
| 2 | 8.94 | 1/4 |
| 3 | 13.41 | 1/8 |

9. Health officials are concerned about radon levels in homes. The half-life of radon-222 is 3.82 days. If a sample of gas taken from a basement contains 4.38 μg of radon-222, how much will remain in the sample after 15.2 days?

| HL | T | A |
|----|---------|------------|
| 0 | 0 | 4.38 mg |
| 1 | 3.82 d | 2.19 mg |
| 2 | 7.64 d | 1.095 mg |
| 3 | 11.46 d | 0.5475 mg |
| 4 | 15.28 d | 0.27375 mg |

10. If the half-life of iodine-131 is 8.10 days, how long will it take a 50 g sample to decay to 6.25 g?

| HL | T | A |
|----|--------|-------|
| 0 | 0 | 50g |
| 1 | 8.10 d | 25g |
| 2 | 16.2 d | 12.5g |
| 3 | 24.3 d | 6.25g |