

## 9 SCIENCE CHEMISTRY ASSIGNMENT: URANIUM 2016

Name: \_\_\_\_\_

Form: \_\_\_\_\_



Teacher: \_\_\_\_\_

Due date: 4pm Wednesday 6<sup>th</sup> April

### MARKING KEY

**Aim:** This assignment is based on the documentary: Uranium: Twisting the Dragon's Tail, Part 2.

Host and physicist Dr. Derek Muller unlocks the mysteries of uranium, one of the Earth's most controversial elements. Dr. Muller embarks on an epic journey across the globe to explain the fascinating details of uranium's birth and longevity. Born from the collapse of a star, uranium has brought hope, progress and destruction.

**Video:** Uranium: Twisting the Dragon's Tail Part 2: 54:53min  
<http://www.dailymotion.com/video/x31jrpz>

#### Plagiarism:

You must write in your own words not copy sentences word for word from another student or another source.

Plagiarising = instant zero on assignment and you will have to re-do it.

#### Assessment policy:

Give me a sick note/legitimate reason from parent BEFORE due date = new negotiated due date.

One day late = -20% taken off mark

Two days late = -40% taken off mark

Three days late = mark of zero given

After three days, students are required to attend a detention and are still required to submit the assignment.

**If you are not at school the day this assignment is due,  
please email it to me by 4pm.**

\_\_\_\_\_  
@aranmore.wa.edu.au

### MARKING KEY

## Chernobyl disaster

1. On what date did America drop a uranium bomb on the city of Hiroshima, Japan? (1 mark)

6 August 1945

2. On what date did America drop a uranium bomb on the city of Nagasaki, Japan? (1 mark)

9 August 1945

3. On what date did the Chernobyl disaster occur? (1 mark)

26 April 1986

*One of the atomic reactors was damaged and radiation was released across Europe. Soldiers were ordered to smother the reactor and the Chernobyl firemen were the first on the scene. They were then taken to hospital where they eventually died. The city and countryside around the reactor remains an abandoned exclusion zone: The Chernobyl Exclusion Zone, Ukraine.*



*Medical physicist who works in nuclear medicine (Bionerd) and who has been to the exclusion zone a number of times before, traveled with Dr Derrek Muller to the Chernobyl Exclusion Zone.*

4. What is the device called that detects radiation? (1 mark)

Geiger counter

5. What is radiation measured in? (1 mark)

Microsieverts

6. Describe what natural background radiation is and state what amount it is on average per hour. (2 marks)

Natural background radiation is the level of radiation that naturally occurs on Earth. (1)

The amount of natural background radiation is on average 0.2 microsieverts per hour. (1)

7. Fill in the missing words below.

(5 marks)

Bionerd and Dr Derrek Muller visit Pripyat <sup>(1)</sup>, an abandoned town in the Chernobyl Exclusion Zone. Visitors are allowed into the town but only for brief periods and never overnight. About 50 000 people lived here, mostly workers at the nuclear power plant and their families.

Nuclear reactors split uranium atoms <sup>(1)</sup>, they smash them into fragments and that releases heat <sup>(1)</sup> which is how they generate electricity. When uranium atoms smash they break into smaller fragments and when the Chernobyl reactor blew, it spread those fragments across the city like dust.

The coating of smashed uranium atoms is not coated evenly over the city so there are hot <sup>(1)</sup> spots, which are really dangerous, even lethal.

The radiation is invisible <sup>(1)</sup>. You can't feel it, you can't smell it or see it.

*Bionerd and Dr Derrek Muller explored the hospital where the firemen were taken after they fought the fires at the Chernobyl reactors. Their clothing was still in the basement. Radiation in the basement may be 10000 times the natural background radiation, which is dangerous and why they used protective coverings and masks. They did not want to breath in or ingest the radiation. The main radiation in the hospital was from one particular fragment of split uranium atoms called caesium-137.*



8. Caesium-137 is a radioisotope of caesium. Explain what this means (minimum of three sentences) (3 marks)

Caesium-137 is an isotope of caesium, this means <sup>(1)</sup>  
it has a different number of neutrons in its nucleus.  
Caesium-137 is unstable <sup>(1)</sup> and has a nucleus.  
that may undergo the process of nuclear reaction <sup>(1)</sup>  
at any time.

9. Fill in the table below comparing caesium and caesium-137.

(10 marks)

Substance	Symbol	Atomic number	Number of protons	Number of neutrons	Number of electrons
Caesium	Cs <sup>(1)</sup>	55 <sup>(1)</sup>	55 <sup>(1)</sup>	78 <sup>(1)</sup>	55 <sup>(1)</sup>
Caesium-137	<sup>137</sup> Cs <sup>(1)</sup>	55 <sup>(1)</sup>	55 <sup>(1)</sup>	82 <sup>(1)</sup>	55 <sup>(1)</sup>

Bionerd and Dr Derrek Muller stayed in the basement for only four minutes but that was enough. If they stayed down there for an hour, they would have been exposed to the amount of radiation you would normally receive throughout one year.

10. Explain why receiving your dose of radiation all at once is much worse than having it spread throughout the year (in full sentences). (1 mark)

Over a full year, your body has time to repair any damage.

11. List two (2) biological effects of being exposed to high doses of radiation. (2 marks)

- Damages your immune system.
- Damages DNA.
- Cells stop functioning.

(1 mark each)

#### Half-life

11. In your own words, explain what 'half-life' refers to (minimum of two sentences). (2 marks)

Half-life refers to the rate at which radioactive atoms decay. It is the time that it takes for half of a substance's radioactive atoms to decay.

13. What is the half-life of caesium-137? (1 mark)

30 years.

14. What is the half-life of uranium-238? (1 mark)

4.5 billion years

- 15a. State the name given to the confinement structure that encases the damaged nuclear reactor. (1 mark)

Sarcophagus.

b. Explain why the new confinement structure is only a temporary solution (minimum of two sentences). (2 marks)

The half-life of uranium-238 is 4.5 billion (1)  
years which means that a new confinement  
structure, which may only last 100 years will  
keep needing to be replaced. (1)

16. It's been about 30 years since the Chernobyl accident. Explain why people will not be able to live in Pripjat, Ukraine for hundreds of years (minimum of two sentences). (2 marks)

Radiation is still being released because only (1)  
half of the radioactive atoms have decayed.  
This means that the area is still dangerous. (1)

### Medical use

Australia's one and only nuclear reactor is housed at the Australian Nuclear Science and Technology Organisation in Sydney. This is not a power reactor but a research reactor where they create medicine and technology. Highly radioactive technetium-99m was injected into Jason Batson which acts as a radioactive tracer. The machine detects the gamma rays and makes a picture of them as technetium-99m gathers where there are fast growing cells.



17. State the name given to the type of scan that Jason had and describe the purpose of Jason having this scan. (2 marks)

Positron emission tomography / PET scan. (1)  
The purpose of this scan is to determine if  
there are any cancerous tumours in his body. (1)

18. State the half-life of technetium-99m.

(1 mark)

6 hours

## Book

Diagram illustrating the components of a book citation:

Labels: Last name of author, Year, Book title, Initial of first name of author, Place of publication, Publisher.

Citation: Gray, T. (2009). *The Elements: a Visual Exploration of Every Known Atom in the Universe*. New York, USA: Black Dog & Leventhal Publishers, Inc.

## Book with two authors

Shermer, M., & Benjamin, A. (2006). *Secrets of Mental Math: The Mathemagician's Guide to Lightning Calculation and Amazing Mental Math Tricks*. New York, USA: Three Rivers Press.

## Book with three or more authors

Bulliet, R. W., Alley, R. B., Broecker, W. S., & Denton, G. H. (2011). *The fate of Greenland: Lessons from abrupt climate change*. Cambridge, MA: MIT Press.

## Book with editor

Kasdorf, W. E. (Ed). (2003). *The Columbia guide to digital publishing*. New York, USA: Columbia University Press.

## Website

Diagram illustrating the components of a website citation:

Labels: Initial of first name of author, Year, Web page title, Last name of author, URL of the web page.

Citation: Vloothuis, J. (2015). Insight on Painting Seascapes. Retrieved from <http://www.artistsnetwork.com/articles/art-demos-techniques/insight-on-painting-seascapes>

## Website with no author (put title of page at the front)

Aranmore Catholic College. (2014). Retrieved from <http://www.aranmore.wa.edu.au/>

## Website with no date

The Zadkine Museum. (n.d). Retrieved <http://www.france.fr/en/museums/zadkine-museum.html>

## Video file

Diagram illustrating the components of a video file citation:

Labels: Screen name, Date, Title of video, URL of video.

Citation: NeverlandHeroes. (2015, February 19). *Peter Pan: Return to Neverland* [Video file]. Retrieved from <https://www.youtube.com/watch?v=WZIAiuUo6XI>

## Reference list

**Minimum of two references.**

(1 mark)

Referenced using the APA style shown on the previous page.

(1 mark)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be a standard notebook page or a sheet of stationery. There is no handwriting or other markings on the page.

Assignment is neatly written or typed.

(1 mark)

**Correct grammar and spelling.**

(1 mark)

**Total mark:**

/44

**%**

**Teacher comments:**

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