Science 10

Name:_____
Block:____ Date:_____

Chapter 7 Review

1. Radioactivity is the release of high energy particles and rays from a substance as a result of changes in the nuclei of its atoms.
2. background radiation is the term for the radiation we come into contact with everyday that is all around us. Generally, since this type of radiation is all around us, it is viewed as harmless.
3. List the different types of wave/rays in the electromagnetic spectrum from lowest frequency/energy to highest frequency/energy.

Lowest Energy → Highest Energy

radio waves / microwaves — infrared — visible light — UV — x-rays — gamma rays

4. visible light is the one form of radiation that humans can actually see.
5. isotope is the term given to different atoms of a particular element that have the same number of protons, but different numbers of neutrons.
6. The atomic number of an element is the same as the number of protons. The mass number of an element represents the number of protons and neutrons added together.
7. Describe how you can find how many neutrons are in a certain isotope of an element if the atomic number is 52 and the mass number is 134.

mass number − atomic number
134 − 52 = 82 neutrons

8. Standard atomic notation represents the chemical symbol the mass number and the atomic number of a specific isotope.
9. Describe the element, atomic number, number of protons, mass number, and number of neutrons for the following standard atomic notation: $^{41}_{19}K$

mass number → 41
atomic number/protons → 19
K ← element

neutrons = 41 − 19 = 22

10. What do all isotopes of the same element have in common?

same # protons

11. How do isotopes of the same element differ?

neutrons

carbon-12
carbon-14

12. Complete the following table:

Isotope	Atomic Number	# of Protons	Mass Number	# of Neutrons
Carbon-13	6	6	13	7
Cobalt-59	27	27	59	32
Sodium-23	11	11	23	12
Arsenic-75	33	33	75	42
Chlorine-37	17	17	37	20

13. Radioactive atoms emit energy because their nuclei are unstable.

14. The process in which unstable nuclei lose energy (thus gaining stability) by emitting radiation is known as radioactive decay.

15. Isotopes that are capable of radioactive decay are called radioisotopes.

16. The three main types of emitted radiation are alpha radiation, beta radiation, and gamma radiation. This was first discovered by Ernst Rutherford.

17. Alpha radiation is a stream of alpha particles that have the same combination of particles as the nucleus of a Helium atom, with a mass number of 4 and an atomic number of 2.

18. Alpha particles are made up of 2 protons and 2 neutrons.

19. Alpha particles are much larger than other types of radiation making them relatively slow and the least penetrating of the three types of radiation.

20. The term used to describe the emission of an alpha particle from a nucleus is alpha decay.

21. Complete the following nuclear reactions involving alpha decay:

a) $^{208}_{84}\text{Po} \rightarrow {}^{204}_{82}\text{Pb} + {}^{4}_{2}\alpha$

b) $^{225}_{89}\text{Ac} \rightarrow {}^{221}_{87}\text{Fr} + {}^{4}_{2}\text{He}$

c) ${}^{196}_{79}\text{Au} \rightarrow {}^{192}_{77}\text{Ir} + {}^{4}_{2}\alpha$

22. A Beta particle is an electron. Electrons have a negligible mass that is approximately 1/2000 the mass of a proton or neutron, therefore electrons are assigned a mass of 0.

23. Beta particles (electrons) have a charge of -1.

24. During beta decay a neutron changes into a proton and an electron. During this process the proton stays in the nucleus while the electron shoots out from the nucleus with a significant amount of energy.

25. Since the only thing emitted during beta decay is an electron, the mass number remains unchanged and the atomic number increases by one.

26. Complete the following nuclear reactions involving beta decay:

a) $^{6}_{2}\text{He} \rightarrow {}^{6}_{3}\text{Li} + {}^{0}_{-1}\beta$

b) ${}^{14}_{6}\text{C} \rightarrow {}^{14}_{7}\text{N} + {}^{0}_{-1}\beta$

c) $^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^{0}_{-1}\beta$

27. Gamma radiation consists of high energy rays with a short wavelength.

28. Gamma radiation has almost no mass and no charge, therefore during gamma decay both the atomic number and mass number remain unchanged.

29. Gamma rays are one of the most penetrating forms of electromagnetic radiation; they have much more energy than either alpha or beta. radiation.

30. Due to its insignificant size, gamma radiation has the greatest penetration of the three major types of radiation. It would take a thick block of lead or concrete to stop it.

31. In gamma decay reaction equations we use the symbol (*) to represent that a certain nucleus has extra energy.

32. Complete the following nuclear reactions involving gamma decay:

a) $^{60}_{28}\text{Ni}^{*} \rightarrow {}^{60}_{28}\text{Ni} + {}^{0}_{0}\gamma$

b) $^{40}_{19}\text{K}^{*} \rightarrow {}^{40}_{19}\text{K} + {}^{0}_{0}\gamma$

c) $^{24}_{11}\text{Na}^{*} \rightarrow {}^{24}_{11}\text{Na} + {}^{0}_{0}\gamma$

33. The symbol α is used to represent an alpha particle, the symbol β is used to represent a beta particle and the symbol γ is used to represent a gamma ray.

34. Alpha particles can also be represented by a He nucleus, and beta particles can also be represented by an e.

35. In nuclear equations, the mass number and the atomic number remain constant.

36. Carbon dating (also known as radiocarbon dating) is the process of determining the age of an object by measuring the amount of carbon-14 remaining in that object.

37. Describe the process of carbon dating. What is the maximum age of an object that can be determined by carbon dating? comparing carbon-14 to nitrogen 14 in an object, to determine how many half lives have passed. approx 50 000 years (just under 10 $\frac{1}{2}$ lives)

38. A half-life is a constant for any radioactive isotope and is equal to the time required for $\frac{1}{2}$ the nuclei in a sample to decay. ~~For example, carbon-14 has a half-life of _____ years, radon-222 has a half-life of _____ days and uranium-238 has a half-life of _____ billion years.~~

39. If the half-life for an isotope is 35 days, how much of a 10g sample would remain after:

a) 35 days? 5g b) 70 days? 2.5g c) 105 days? 1.25g

40. A decay curve is a curved line on a graph that shows the rate at which radioactive isotopes decay.

41. Explain how you would determine how much of a 50g sample of iodine-131 would remain if its half-life is 8 days and 32 days have passed since the sample was made?

days	0	8	16	24	32
grams	50	25	12.5	6.25	3.125

3.125g

42. The isotope that undergoes radioactive decay is called the parent and the stable product of radioactive decay is called the daughter.

43. There are many common isotope pairs that exist. For example, the daughter isotope for carbon-14 is nitrogen-14 and the parent isotope for lead-207 is uranium-235.

44. Explain how we can use potassium-40 and argon-40 as a clock.

compare ratio of parent to daughter to determine # of half lives

Parent : daughter	
1:1	1 half life
1:3	2 half lives.

45. The two types of nuclear reactions include fusion and fission.

46. Nuclear fission involves the _____ of a larger nucleus into two smaller nuclei, subatomic particles and energy. The fission of a nucleus is accompanied by a _____ release of energy.

47. Larger, heavier nuclei tend to be _____, and in order to increase stability, atoms with heavy nuclei split into lighter atoms.

48. What are the downsides of performing fission reactions using nuclear reactors?

49. A nuclear reaction is a process in which the nucleus of an atom changes. This change occurs when the nucleus _____ or _____ particles or energy. A small change in mass during nuclear reactions results in a large change in _____.

50. Nuclear reactions are quite remarkable. A fission reaction involving just _____ gram of uranium-235 releases the same amount of energy as burning _____ of coal!

51. Scientists have also developed methods in forcing nuclear reactions to occur. The term for this type of nuclear reaction is an _____. During these forced reactions, a nucleus is _____ with alpha particles, beta particles, or gamma rays.

52. Describe the process of the induced uranium-235 nuclear fission reaction that occurs in both fission-style nuclear weapons and in Canadian nuclear power plants. Be sure to include the production of the unstable uranium-236 isotope in your explanation, as well as all the reactants and products of the reaction.

53. Why is the release of neutrons, krypton-92 and barium-141 in the induced uranium-235 reactions important?

54. The term used to describe the ongoing process in which one reaction initiates another or more reactions is a _____. These types of reactions can produce increasingly rapid amounts of _____ and may lead to _____ nuclear explosions.

55. Chain reactions can be controlled using _____ to absorb neutrons.

56. Explain why chain reactions are a concern in nuclear power plants.

57. Explain what CANDU stands for, how it works and why it is a modern leader in the nuclear technology of the world.

58. The fuel used in CANDU reactors comes in the form of _____ containing uranium pellets. Once used, they are placed deep underground in _____ rock formations.

59. Nuclear fission is the process in which _____ low mass nuclei join together to form a more _____ nucleus. This type of reaction occurs on the _____, as well as on other _____.

60. Fusion reactions require a tremendous amount of _____ and _____ to occur.

61. Describe the fusion reaction that occurs in the Sun.

62. What do fission and fusion reactions have in common?

63. How do fission and fusion reactions differ? Be sure to consider the reactants, the products, and human usage.

Vocabulary to Know:

Write a concise definition of each of these terms found in this chapter.

Alpha decay:

Alpha particle:

Beta decay:

Beta particle:

CANDU:

Chain reaction:

Daughter isotope:

Decay curve:

Fission:

Fusion:

Gamma decay:

Gamma ray:

Half-life:

Hazardous wastes:

Induced nuclear reaction:

Isotopes:

Light:

Mass number:

Nuclear equation:

Nuclear reaction:

Parent isotope:

Potassium-40 clock:

Radiation:

Radioactive decay:

Radiocarbon dating: