MC #21-28 will directly be question types on the test

Name: _____ Review for Chapter

1. What are the characteristics of a neutron?
(1) It has no charge and a mass of 1 amu.
(2) It has no charge and no mass.
(3) It has a charge of +1 and a mass of 1 amu.
(4) It has a charge of +1 and no mass.

2. In which group do the particles contain only nucleons?
(1) protons and electrons
(2) neutrons and electrons
(3) protons and neutrons
(4) protons, neutrons, and electrons

3. The major portion of an atom's mass consists of
(1) neutrons and positrons
(2) neutrons and protons
(3) electrons and protons
(4) electrons and neutrons

4. In Rutherford's gold foil experiments, some alpha particles were deflected from their original paths but most passed through the foil with no deflection. Which statement about gold atoms is supported by these experimental observations?
(1) Gold atoms are similar to alpha particles.
(2) Gold atoms consist mostly of empty space.
(3) Alpha particles are more dense than gold atoms.
(4) Alpha particles and gold nuclei have opposite charges.

5. What is the atomic number of an element that has six protons and eight neutrons?
(1) 6
(2) 2
(3) 8
(4) 14

6. What is the nuclear charge of an iron atom (Fe)?
(1) +26
(2) +30
(3) +56
(4) +82

7. An atom contains 22 neutrons and 40 nucleons. What is the total number of protons in the atom?
(1) 62
(2) 40
(3) 22
(4) 18

8. What is the total number of electrons in an atom of an element with an atomic number of 18 and a mass number of 40?
(1) 58
(2) 40
(3) 22
(4) 18

9. What is the total number of protons contained in the nucleus of a carbon-14 atom?
(1) 8
(2) 6
(3) 14
(4) 12

10. Compared to the charge and mass of a proton, an electron has
(1) the same charge and the same mass
(2) the same charge and a smaller mass
(3) an opposite charge and the same mass
(4) an opposite charge and a smaller mass

11. As the number of neutrons in the nucleus of a given atom of an element increases, the atomic number of that element
(1) decreases
(2) increases
(3) remains the same

12. The number of neutrons in the nucleus of an atom can be determined by
(1) subtracting the atomic number from the mass number
(2) adding the atomic number to the mass number
(3) subtracting the mass number from the atomic number
(4) adding the mass number to the atomic mass

13. Which of the following particles has the *least* mass?
(1) an electron
(2) a proton
(3) a hyrogen atom
(4) a neutron

14. Atoms of the same element that have different numbers of neutrons are classified as
(1) isomers
(2) isotopes
(3) charged atoms
(4) charged nuclei

This Page will not directly be on the test but you'll need to know the concepts

40. 20 grams of a radioisotope decayed to 2½ grams in 3.6 seconds. What is the half-life?

41. A radioisotope has a half-life of 2.60 days. 5 grams remain after 10.4 days. What was the initial amount of the radioisotope?

42. A radioisotope has a half-life of 8.5 minutes. After 25.5 minutes, 10 grams remain. What was the initial amount?

43. Contrast natural and artificial transmutation.

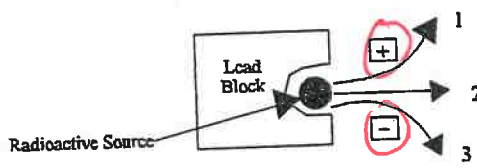
44. Compare and contrast fission and fusion reactions.

45. Explain the benefits and risks of radioactive isotopes.

46. Complete the data table and construct a graph showing the amount of ^{60}Co remaining after different amounts of time. The initial amount is 10 grams and the half-life is 5.25 years, as shown on *Table N*. Remember to label axes, plot and connect the points, and title the graph.

Time, years	Amount remaining, grams
0	10
5.25	20
10.5	40
15.75	60
21	80

he diagram below represents radiation passing through an electric field.



Which type of emanation is represented by the arrow labeled 2?
1) alpha particle
2) beta particle
3) positron
4) gamma radiation

Which radioactive sample would contain the greatest remaining mass of the radioactive isotope after 10 years?
1) 2.0 grams of ^{198}Au
2) 2.0 grams of ^{42}K
3) 4.0 grams of ^{32}P
4) 4.0 grams of ^{60}Co

In how many days will a 12-gram sample of $^{131}_{53}I$ decay to 1.5 grams?
(1) 8.0 (2) 16 (3) 20 (4) 24

Bombarding a nucleus with high-energy particles that change it from one element into another is called
(1) a half-reaction
(2) a breeder reaction
(3) artificial transmutation
(4) natural transmutation

adioisotopes used in medical diagnosis should have
(1) short half-lives and be quickly eliminated from the body
(2) short half-lives and be slowly eliminated from the body
(3) long half-lives and be quickly eliminated from the body
(4) long half-lives and be slowly eliminated from the body

A radioisotope is called a tracer when it is used to
(1) kill bacteria in food
(2) kill cancerous tissue
(3) determine the age of animal skeletal remains
(4) determine the way in which a chemical reaction occurs

3. Which radioactive isotope is used in geological dating?
(1) uranium-238
(2) iodine-131
(3) cobalt-60
(4) technetium-99

34. The radioisotope I-131 is used to
(1) control nuclear reactions
(2) determine the age of fossils
(3) diagnose thyroid disorders
(4) trigger fusion reactors.

CONSTRUCTED RESPONSE QUESTIONS: Parts B-2 and C of NYS Regents Exam

35. What ratios of particles make a nucleus stable? How can you tell whether an atom is stable?

36. A. Compare and contrast alpha, beta, gamma, and positron in terms of mass and charge.
B. Write the equation for the alpha decay that occurs in a smoke detector containing Americium-241 (Am-241).
C. Write the equation for the beta decay of Cobalt-60 (Co-60) used in cancer treatment.
D. How is the radioactive decay of Krypton-85 different from the radioactive decay of Amricium-241?

37. ^3H has a half-life of 12.26 years. Find the fraction remaining after 49 years. Hint: See Table N (half-life).

38. Find the fraction remaining of K-42 after 25 hours. Hint: See Table N (half-life).

39. 100 grams of a radioisotope decayed to 6¼ grams after 21 years. What is the half-life?

. Which substance is used as a moderator in a nuclear reactor?
(1) aluminum (2) graphite (3) plutonium (4) helium

. The main purpose of the moderator in a fission reactor is to
(1) remove heat (2) produce heat
(3) slow down neutrons (4) speed up neutrons

. In a nuclear reactor, the neutrons can be slowed by collisions with
(1) uranium atoms (2) graphite (3) cadmium (4) boron

. In a fission reaction, which of the following is needed to continue the chain reaction?
(1) protons (2) neutrons (3) electrons (4) gamma radiation

. Which of the following could be used as a fuel in a nuclear fission reactor? (1) U-235 (2) U-238 (3) protium (4) deuterium

. In a nuclear reactor, the radioisotope U-235 serves as a
(1) shield (2) coolant
(3) neutron absorber (4) fissionable material

. A requirement for a fusion reactor is (1) extremely high temperatures (2) heavy atomic nuclei as fuel (3) inexpensive equipment (4) operators with little training

. In a nuclear reactor the amount of uranium present remains fairly constant. The rate of the reaction is controlled by the amount of
(1) barium (2) alpha particles (3) beta particles (4) neutrons

. A substance which can be used both as the moderator and the coolant in a nuclear reactor is (1) graphite (2) cadmium (3) liquid sodium (4) plutonium

. A sample of wood was analyzed and found to have only 1/2 the ratio of C-14 to C-12 as in a living sample. (The half-life of C-14 = 5700 years.) The wood is probably about (1) 2800 years old (2) 5700 years old (3) 11,200 years old (4) 17,000 years old

. A reactor in which more fuel is produced is called a (1) fusion reactor (2) breeder reactor (3) steam reactor (4) reversible reactor

. The fuel produced in a breeder reactor is (1) uranium (2) plutonium (3) cadmium (4) helium

. When radioisotopes are used in medical treatment or diagnosis and are ingested by the patient, it is important that they (1) be inexpensive (2) have long half-lives (3) have short half-lives (4) emit only alpha radiation

. Which of the following radioisotopes is used in the diagnosis of the diseases of the thyroid? (1) I-131 (2) Co-60 (3) Tc-99 (4) U-235

. A radioisotope that is sometimes used by doctors to pinpoint a brain tumor is (1) carbon-12 (2) lead-206 (3) technetium-99 (4) uranium-238

. Which particle is electrically neutral?
(1) proton (2) positron (3) neutron (4) electron

. What is the mass number of a deuterium atom?
(1) 1 (2) 2 (3) 3 (4) 4

. Which particle cannot be accelerated by the electric or magnetic fields in a particle accelerator?
(1) neutron (2) proton (3) alpha particle (4) beta particle

. A device used to give charged particles sufficient kinetic energy to penetrate the nucleus of an atom is
(1) an accelerator (2) an electroscope
(3) a Geiger counter (4) a scintillation counter

. Given the reaction:

$$^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$$

This reaction is best described as (1) beta decay (2) artificial transmutation (3) fission (4) fusion

. Which equation represents artificial transmutation?
(1) $H_2O \rightarrow H^+ + OH^-$ (2) $UF_6 + 6Na \rightarrow 6NaF + U$
(3) $^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$ (4) $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$

. Given the equation:

$$^{239}_{92}U + {}^{4}_{2}He \rightarrow {}^{241}_{94}Pu + {}^{1}_{0}n$$

This reaction is an example of (1) addition (2) condensation (3) substitution (4) transmutation

. In the reaction:

$$X + {}^{1}_{1}H \rightarrow {}^{4}_{3}Li + {}^{4}_{2}He$$

The nucleus represented by X is
(1) $^{4}_{3}Li$ (2) $^{10}_{5}B$ (3) $^{9}_{4}Be$ (4) $^{10}_{6}C$

. In the reaction:

$$^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{4}_{2}He + X$$

The species represented by X is
(1) $^{1}_{1}H$ (2) $^{2}_{1}H$ (3) $^{3}_{2}He$ (4) $^{4}_{2}He$

. Which of the following nuclei would have the greatest binding energy per nucleon? (1) hydrogen (2) helium (3) iron (4) uranium

2. Which radioactive waste can be stored for decay and then safely released directly into the environment? (1) N-16 (2) Sr-90 (3) Cs-137 (4) Pu-239

3. Which equation represents a nuclear reaction that is an example of artificial transmutation?

(1) $^{43}_{21}Sc \rightarrow {}^{43}_{20}Ca + {}^{0}_{+1}e$ (2) $^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{17}_{8}O + {}^{1}_{1}H$

(3) $^{10}_{4}Be \rightarrow {}^{10}_{5}B + {}^{0}_{-1}e$ (4) $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

4. In the construction of some nuclear reactors, a radiation barrier of concrete is used as the (1) external shield to protect reactor walls (3) internal shield to protect reactor walls (3) external shield to protect personnel (4) internal shield to protect personnel

5. The operation of a commercial nuclear reactor in New York State requires an isotope that will undergo (1) fission and controlled chain reaction (2) fission and an uncontrolled chain reaction (3) fusion and a controlled chain reaction (4) fusion and an uncontrolled chain reaction

6. Which particle can *not* be accelerated by the electric or the magnetic field in a particle accelerator? (1) electron (2) neutron (3) helium nucleus (4) hydrogen nucleus

7. A radioactive-dating procedure to determine the age of a mineral compares the mineral's remaining amounts of isotope ^{238}U and isotope (1) ^{206}Pb (2) ^{206}Bi (3) ^{214}Pb (4) ^{214}Bi

8. The fission process in a reactor can be regulated by adjusting the number of neutrons available. This is done by the use of (1) moderators (2) control rods (3) coolants (4) shielding

9. Particle accelerators can be used to increase the kinetic energy of (1) deuterium (2) neutrons (3) protons (4) tritium

10. Given the reaction $^{7}_{3}Li + X \rightarrow {}^{8}_{4}Be$

Which species is represented by *X*?

(1) $^{1}_{1}H$ (2) $^{2}_{1}H$ (3) $^{3}_{2}He$ (4) $^{4}_{2}He$

1. In a nuclear reactor, the purpose of the moderator is to (1) absorb neutrons (2) split neutrons (3) produce neutrons (4) slow down neutrons

2. In a nuclear reactor, the radioisotope U-235 serves as a (1) shield (2) coolant (3) neutron absorber (4) fissionable material

3. Given the nuclear reaction:

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{138}_{56}Ba + {}^{95}_{36}Kr + 3{}^{1}_{0}n + \text{energy}$$

This equation can best be described as (1) fission (2) fusion (3) natural decay (4) endothermic

4. The most abundant isotope found in a naturally occurring uranium deposit is (1) $^{233}_{92}U$ (2) $^{235}_{92}U$ (3) $^{238}_{92}U$ (4) $^{239}_{92}U$

5. A fusion reaction differs from a fission reaction in that the fusion reaction to be initiated requires (1) extremely low temperatures (2) extremely high temperatures (3) heavy atomic nuclei as fuels (4) neutrons with low kinetic energy

6. The ratio of uranium-238 to lead-206 in a mineral is used to determine its (1) age (2) density (3) solubility (4) composition

7. The fuels that may be used in a fusion reaction

Radioisotopes used for medical diagnosis must have (1) long half-lives and be quickly eliminated by the body (2) long half-lives and be slowly eliminated by the body (3) short half-lives and be quickly eliminated by the body (4) short half-lives and be slowly eliminated by the body

Compared to an ordinary chemical reaction, a fission reaction will
(1) release smaller amounts of energy
(2) release larger amounts of energy
(3) absorb smaller amounts of energy
(4) absorb larger amounts of energy

The primary purpose of the moderator used in a nuclear reactor is to (1) absorb protons (2) absorb neutrons (3) slow protons (4) slow neutrons

Which fissionable elements are produced in breeder reactors?
(1) lithium-6 and hydrogen-3
(2) carbon-14 and oxygen-17
(3) uranium-233 and plutonium-239
(4) cesium-137 and radon-222

Given the equation: $^{14}_{7}N + {}^{4}_{2}He \rightarrow X + {}^{17}_{8}O$

When the equation is correctly balanced, the particle represented by the X will be

(1) $^{0}_{-1}e$ (2) $^{1}_{0}n$ (3) $^{1}_{1}H$ (4) $^{2}_{1}H$

Which substance may serve as both a moderator and coolant in some nuclear reactors? (1)carbon dioxide (2) boron (3) graphite (4) heavy water

Iodine-131 is used for diagnosing thyroid disorders because it is absorbed by the thyroid gland and (1) has a very short half-life (2) has a very long half-life (3) emits alpha radiation (4) emits gamma radiation

Which element is sometimes used as a moderator in a nuclear reactor? (1) C (2) Cu (3) Al (4) Zn

↳ graphite

Given the nuclear reaction: $^{12}_{6}C + {}^{2}_{1}H \rightarrow X + {}^{1}_{0}n$

When the equation is correctly balanced, the nucleus represented by the X is (1) $^{14}_{6}N$ (2) $^{13}_{7}N$ (3) $^{13}_{7}C$ (4) $^{13}_{6}C$

In a fission reaction uranium-235 is used as a
(1) coolant (2) moderator (3) fuel (4) control rod

The waste products from nuclear reactors can be in the form of
(1) solids, only (2) solids and liquids, only (3) solids and gases, only (4) solids, liquids, and gases

Which radioactive isotope is often used as a tracer to study organic reaction mechanisms?
(1) Carbon-12 (2) carbon-14 (3) uranium-235 (4) uranium-238

In the reaction $^{27}_{13}Al + {}^{4}_{2}He \rightarrow X + {}^{1}_{0}n$, the isotope represent by X is

this is Artificial Transmutation

(1) $^{29}_{12}Mg$ (2) $^{28}_{13}Al$ (3) $^{27}_{14}Si$ (4) $^{30}_{15}P$

don't need to know

Which substance may be used as both the coolant and moderator in a reactor? (1) boron (2) cadmium (3) heavy water (4) solid graphite

The equation $^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{4}_{2}He$ represents (1) alpha decay (2) beta decay (3) fission (4) fusion

Which particle cannot be accelerated by the electric or magnetic fields in a particle accelerator? (1) neutron (2) proton (3) alpha particle (4) beta particle

↳ No charge

A nuclear reactor that produces fissionable material as well as energy is a (1) fission reactor (2) fusion reactor (3) breeder reactor (4) hydrogen reactor

The number of available neutrons in a fission reactor is limited by the (1) coolant (2) control rods (3) shielding (4) moderator

A radioactive gas that is a waste product of nuclear reactors is (1) carbon-12 (2) nitrogen-16 (3) oxygen-16 (4) nitrogen-14

↳ Not p^+:n^0 Ratio

Which of the following is true of plutonium-239? (1) It is produced in a fusion reactor. (2) It has a short half-life. (3) It is nontoxic. (4) It is a fissionable material.

it's made in a Breeder Reactor

The energy released by nuclear fusion is produced by (1) an ordinary chemical reaction (2) the conversion of mass into energy (3) the splitting of a heavy atom (4) the conversion of energy into mass

It is thought that the sun's energy is produced by (1) nuclear fission (2) ordinary exothermic chem-

↳ fusion

Has to be Stable + Pb is Stable got cut off

A technique for diagnosing disorders of the thyroid uses (1) iodine-131 (2) plutonium-239 (3) carbon-14 (4) uranium-238

Deuterium and tritium are (1) used in radioactive dating (2) isotopes of hydrogen (3) fuels in fission reactors (4) waste products of breeder reactors

In the reaction

$$X + {}^{1}_{1}H \rightarrow {}^{6}_{3}Li + {}^{4}_{2}He$$

the nucleus represented by X is (1) $^{9}_{3}Li$ (2) $^{10}_{5}B$ (3) $^{9}_{4}Be$ (4) $^{10}_{6}C$

Which equation represents artificial transmutation?
(1) $H_2O \rightarrow H^+ + OH^-$
(2) $UF_6 + 6Na \rightarrow 6NaF + U$
(3) $^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$
(4) $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$

An example of a radioisotope used as a tracer is (1) C-12 (2) N-14 (3) C-14 (4) Th-234

The end product of the decay of U-238 is (1) Pa-234 (2) U-235 (3) Pb-206 (4) Pu-239

The number of known isotopes of hydrogen is (1) 1 (2) 2 (3) 3 (4) 4

When a living thing dies, the amount of C-14 (1) increases (2) decreases (3) remains the same

Which atom can undergo nuclear fission when its nucleus captures a neutron? (1) $^{1}_{1}H$ (2) $^{2}_{1}H$ (3) $^{235}_{92}U$ (4) $^{238}_{92}U$

SON

For a given mass, the energy released is greatest for a reaction involving (1) slow oxidation (2) rapid oxidation (3) fission (4) fusion

When a uranium nucleus breaks up into fragments, which type of nuclear reaction occurs?
(1) fusion (2) fission
(3) replacement (4) redox

The energy equivalent of the mass defect is known as (1) an alpha particle (2) binding energy (3) half-life (4) kinetic energy

The equation $^{1}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{1}He$ represents (1) fusion (2) fission (3) alpha decay (4) k-capture

Whenever protons and neutrons combine to form a stable nucleus, the

15. What is the total number of protons in the nucleus of an atom of potassium-42?
(1) 39
(2) 42
(3) 15
(4) 19

16. Which particles are isotopes of each other?
(1) $^{5}_{1}X$ and $^{3}_{2}X$
(2) $^{2}_{1}X$ and $^{4}_{2}X$
(3) $^{2}_{1}X$ and $^{3}_{2}X$
(4) $^{1}_{1}X$ and $^{3}_{1}X$

17. The nucleus of which atom contains 48 neutrons?
(1) $^{85}_{37}Rb$
(2) $^{112}_{48}Cd$
(3) $^{32}_{16}S$
(4) $^{48}_{22}Ti$

18. Which atoms are isotopes of the same element?
(1) $^{20}_{10}X$ and $^{20}_{11}X$
(2) $^{24}_{12}X$ and $^{25}_{12}X$
(3) $^{31}_{19}X$ and $^{31}_{19}X$
(4) $^{31}_{15}X$ and $^{32}_{16}X$

19. Element X has two isotopes. If 72.0% of the element has an isotopic mass of 84.9 atomic mass units, and 28.0% of the element has an isotopic mass of 87.0 atomic mass units, the average atomic mass of element X is numerically equal to
(1) $\frac{(72.0 \times 84.9)}{100} + \frac{(28.0 \times 87.0)}{100}$
(2) $(72.0 \times 84.9) + (28.0 \times 87.0)$
(3) $(72.0 + 84.9) \times (28.0 + 87.0)$
(4) $(72.0 - 84.9) \times (28.0 + 87.0)$

20. The atomic mass of an element is defined as the weighted average mass of that element's
(1) least abundant isotope
(2) most abundant isotope
(3) radioactive isotopes
(4) naturally occurring isotopes

21. Which type of radiation is identical in mass and charge to a helium nucleus?
(1) beta
(2) alpha
(3) proton
(4) positron

22. When $^{226}_{88}Ra$ undergoes a natural transmutation reaction, it emits
(1) a beta particle
(2) an alpha particle
(3) a neutron
(4) a proton

Table N

23. Which type of emission has the highest penetrating power?
(1) beta
(2) alpha
(3) gamma
(4) positron

24. Which type of radiation has *neither* mass nor charge?
(1) gamma
(2) neutron
(3) alpha
(4) beta

25. As ^{14}C decays to ^{14}N, the number of protons in the nucleus
(1) decreases
(2) increases
(3) remains the same

$^{14}_{6}C \rightarrow ^{0}_{-1}e + ^{14}_{7}N$

26. The half-life of ^{131}I is 8.07 days. What fraction of a sample of ^{131}I remains after 24.21 days?
(1) $\frac{1}{16}$
(2) $\frac{1}{8}$
(3) $\frac{1}{4}$
(4) $\frac{1}{2}$

$n = \frac{24.21}{8.07} = 3$

$\frac{1}{1} \xrightarrow{1} \frac{1}{2} \xrightarrow{2} \frac{1}{4} \xrightarrow{3} \frac{1}{8}$

27. Which reaction is matched correctly with the particle represented by letter X?
(1) $^{234}_{92}U \rightarrow ^{230}_{90}Th + X$; X is a beta particle.
(2) $^{230}_{90}Th \rightarrow ^{226}_{88}Ra + X$; X is a beta particle.
(3) $^{234}_{90}Th \rightarrow ^{234}_{91}Pa + X$; X is an alpha particle.
(4) $^{226}_{88}Ra \rightarrow ^{222}_{86}Rn + X$; X is an alpha particle.

28. In the equation:
$^{239}_{40}Th \rightarrow ^{234}_{91}Pa + X$
The symbol X represents
(1) $^{1}_{0}n$
(2) $^{1}_{1}H$
(3) $^{0}_{+1}e$
(4) $^{0}_{-1}e$

TYPO in this question

$^{234}_{90}Th \rightarrow ^{234}_{91}Pa + X$

$X = ^{0}_{-1}e$