

Table O Symbols Used In Nuclear Chemistry

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| <p>1 Which particles have approximately the same mass?
 (1) alpha particle and beta particle
 (2) alpha particle and proton
 (3) neutron and positron
 (4) neutron and proton</p> <p>2 Nuclei of U-238 atoms are
 (1) stable and spontaneously absorb alpha particles
 (2) stable and spontaneously emit alpha particles
 (3) unstable and spontaneously absorb alpha particles
 (4) unstable and spontaneously emit alpha particles</p> <p>3 Which nuclear emission has the greatest penetrating power?
 (1) proton (3) gamma radiation
 (2) beta particle (4) positron</p> <p>4 Which particle has no charge?
 (1) electron (3) positron
 (2) neutron (4) proton</p> <p>5 Which statement describes the relative masses of two different particles?
 (1) A neutron has less mass than a positron.
 (2) A beta particle has less mass than a neutron.
 (3) An alpha particle has less mass than a positron.
 (4) An alpha particle has less mass than a beta particle.</p> | <p>6 Which phrase describes the charge and mass of a neutron?
 (1) a charge of +1 and no mass
 (2) a charge of +1 and an approximate mass of 1 u
 (3) no charge and no mass
 (4) no charge and an approximate mass of 1 u</p> <p>7 Which nuclear emission is negatively charged?
 (1) an alpha particle (3) a neutron
 (2) a beta particle (4) a positron</p> <p>8 Compared to an electron, which particle has a charge that is equal in magnitude but opposite in sign?
 (1) an alpha particle (3) a neutron
 (2) a beta particle (4) a proton</p> <p>9 Which list of nuclear emissions is arranged in order from the greatest penetrating power to the least penetrating power?
 (1) alpha particle, beta particle, gamma ray
 (2) alpha particle, gamma ray, beta particle
 (3) gamma ray, alpha particle, beta particle
 (4) gamma ray, beta particle, alpha particle</p> <p>10 Which particle has the least mass?
 (1) a proton (3) a helium atom
 (2) an electron (4) a hydrogen atom</p> <p>11 Which particle has the least mass?
 (1) alpha particle (3) neutron
 (2) beta particle (4) proton</p> |
|---|--|

Base your answers to questions 12 on the information below and on your knowledge of chemistry.

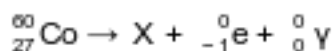
A student compares some models of the atom. These models are listed in the table below in order of development from top to bottom.

Models of the Atom		
Model	Observation	Conclusion
Dalton model	Matter is conserved during a chemical reaction.	Atoms are hard, indivisible spheres of different sizes.
Thomson model	Cathode rays are deflected by magnetic/electric fields.	Atoms have small, negatively charged particles as part of their internal structure.
Rutherford model	Most alpha particles pass straight through gold foil but a few are deflected.	An atom is mostly empty space with a small, dense, positively charged nucleus.
Bohr model	Unique spectral lines are emitted by excited gaseous elements.	Packets of energy are absorbed or emitted by atoms when an electron changes shells.

12 Using the conclusion from the Rutherford model, identify the charged subatomic particle that is located in the nucleus.

Base your answers to questions 13 on the information below and on your knowledge of chemistry.

Cobalt-60 is an artificial isotope of Co-59. The incomplete equation for the decay of cobalt-60, including beta and gamma emissions, is shown below.



13 Compare the penetrating power of the beta and gamma emissions.

Base your answers to questions 14 on the information below and on your knowledge of chemistry.

In the past, some paints that glowed in the dark contained zinc sulfide and salts of Ra-226. As the radioisotope Ra-226 decayed, the energy released caused the zinc sulfide in these paints to emit light. The half-lives for Ra-226 and two other radioisotopes used in these paints are listed on the table below.

Radioisotopes in the Paints	
Radioisotope	Half-Life (y)
Pm-147	2.6
Ra-226	1599
Ra-228	5.8

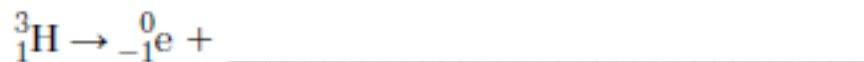
- 14 Complete the nuclear equation below for the beta decay of Pm-147 by writing an isotopic notation for the missing product.



Base your answers to questions 15 on the information below and on your knowledge of chemistry.

Illuminated EXIT signs are used in public buildings such as schools. If the word EXIT is green, the sign may contain the radioisotope tritium, hydrogen-3. The tritium is a gas sealed in glass tubes. The emissions from the decay of the tritium gas cause a coating on the inside of the tubes to glow.

- 15 Complete the nuclear equation below for the radioactive decay of tritium, by writing a notation for the missing product.



Answer Keys

1 4

2 4

3 3

4 2

5 2

6 4

7 2

8 4

9 4

10 2

11 2

12 Allow 1 credit. Acceptable responses include, but are not limited to:

- proton
- p
- p⁺
- ${}^1_1\text{p}$
- ${}^1_1\text{H}$
- H⁺

13 Allow 1 credit. Acceptable responses include, but are not limited to:

- The gamma radiation has more penetrating power than the beta emission.
- The β^- is less penetrating than γ .
- Gamma emissions have greater penetrating power.

14 Allow 1 credit. Acceptable responses include, but are not limited to:

- ${}^{147}_{62}\text{Sm}$
- Sm-147
- ${}^{147}\text{Sm}$
- samarium-147

15 Allow 1 credit. Acceptable responses include, but are not limited to:

- ${}^3_2\text{He}$
- helium-3
- He-3
- ${}^3\text{He}$