

Electromagnetic and Ionizing radiation

Exam 10 — Chapter 33 -The Atomic Nucleus and Radioactivity

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

Date: \_\_\_\_\_

Raw Score: \_\_\_\_\_

Percentage Score: \_\_\_\_\_ %

Proctor for this Examinaton: \_\_\_\_\_ Form: \_\_\_\_\_

**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

- 1) X-rays arise when
  - A) certain radioisotopes decay.
  - B) an outer shell electron is excited by a gamma photon.
  - C) an inner shell electron is ejected by a more energetic electron and an outer shell electron falls into its orbit.
  - D) a beta particle and a positron collide.
  - E) none of the preceding
  
- 2) The individual who, while searching for materials that emitted X-rays, found that a fluorescent uranium compound produced rays that could cloud a photographic plate was
  - A) Pierre Curie.
  - B) Henri Becquerel.
  - C) Wilhelm Roentgen
  - D) Hans Geiger
  - E) none of the preceding.
  
- 3) U-234, U-235 and U-238 are \_\_\_\_\_ of the element uranium
  - A) allotropes
  - B) isomers
  - C) nuclides
  - D) diastereomers
  - E) none of the preceding
  
- 4) Which of the following is not a form of nuclear radiation?
  - A) alpha
  - B) beta
  - C) gamma
  - D) positron
  - E) none of the preceding (i.e. all are forms of nuclear radiation).
  
- 5) Which of the following has the highest specific ionization?
  - A) alpha
  - B) beta
  - C) gamma
  - D) proton
  - E) neutron

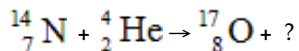
- 6) Which of the following is the most penetrating?
- A) alpha particle
  - B) beta particle
  - C) positron.
  - D) gamma radiation
  - E) neutrino
- 7) The force moderating radioactive decay is
- A) the electromagnetic force.
  - B) the weak force.
  - C) the strong force.
  - D) the gravitational force.
  - E) all of the preceding affect radioactive decay
- 8) In isotopic notation,  ${}^A_Z X$ , the letter 'Z' represents
- A) the number of protons in the atom.
  - B) the number of neutrons in the atom.
  - C) the number of protons and electrons in the atom.
  - D) the number of protons, neutrons and electrons in an atom.
  - E) none of the preceding.
- 9) The number of neutrons in  ${}^{235}_{92}U$  is
- A) 327.
  - B) 143.
  - C) 92.
  - D) 235.
  - E) none of the preceding.
- 10) The strong force that acts on hadrons is only significant at distances of about
- A)  $10^{-6}$  m.
  - B)  $10^{-9}$  m.
  - C)  $10^{-12}$  m.
  - D)  $10^{-15}$  m.
  - E) none of the preceding.
- 11) Which of the following can alter the decay rate of a radioisotope?
- A) temperatures  $> 10,000$  K
  - B) pressures  $> 10^6$  atmospheres
  - C) high intensity electromagnetic radiation
  - D) chemical reactions
  - E) none of the preceding
- 12) Beyond the atomic number of what element are there no longer any stable isotopes?
- A) gold
  - B) mercury
  - C) thallium
  - D) lead
  - E) bismuth

- 13) A tritium traser was demonstrated during the lecture. Tritium has a half-life of about 12.25 years. If there was initially 1.0 microcuries (1.0  $\mu\text{Ci}$ ) sealed in the traser, about how much will remain a century from now?
- A) 0.004  $\mu\text{Ci}$
  - B) 0.010  $\mu\text{Ci}$
  - C) 0.025  $\mu\text{Ci}$
  - D) 0.100  $\mu\text{Ci}$
  - E) none will remain
- 14) Radium was once used to illuminate ZnS-painted watch dials ,but was replaced by another element in the 1960s. This element is the only rare earth (lanthanide) metal that has no stable isotopes. What is it?
- A) cerium
  - B) praseodymium
  - C) promethium
  - D) europium
  - E) thulium
- 15) The only person to have ever been awarded a Nobel prize in both chemistry and physics was
- A) Henri Becquerel.
  - B) Marie Curie.
  - C) Lise Meitner.
  - D) Wilhelm Roentgen.
  - E) Hans Geiger.
- 16) The earliest type of radiation detector was the
- A) electroscope.
  - B) cloud chamber.
  - C) Geiger counter.
  - D) bubble chamber.
  - E) scintillation counter.
- 17) Sodium-22 ( $^{22}_{11}\text{Na}$ ) decays to neon-22 ( $^{22}_{10}\text{Ne}$ ) emitting a gamma photon and what two particles?
- A) alpha and beta
  - B) beta and positron
  - C) beta and neutrino
  - D) positron and neutrino
  - E) positron and antineutrino
- 18)  $^{234}_{90}\text{Th} \rightarrow ^{234}_{91}\text{Pa} + ?$   
 In the above equation the particle being emitted is the
- A) proton
  - B) neutron
  - C) alpha
  - D) beta
  - E) positron
- 19) The conversion of one element to another by radioactive decay is referred to as
- A) nuclear fission.
  - B) atomic emission.
  - C) transmutation.
  - D) spallation.
  - E) none of the preceding.

20) Which of the following represents the non-radioactive end product of the decay of uranium-238?

- A) lead-206
- B) lead-210
- C) bismuth-210
- D) thallium-206
- E) bismuth-214

21) In 1919 Ernest Rutherford succeeded in converting nitrogen-14 to oxygen-17, by bombarding the former with alpha particles, according to the following equation:



What is the missing quantity?



E) none of the preceding

22) Carbon-14 is used in radiometric dating of

- A) rocks
- B) ancient metal artifacts
- C) things that had been alive up to about 50,000 years ago
- D) things that had been alive millions of years ago (fossils)
- E) all of the preceding

23) When a beta particle is emitted from a radionuclide

- A) an up quark changes to a down quark
- B) a down quark changes to an up quark
- C) a top quark changes to a bottom quark
- D) a bottom quark changes to a top quark
- E) a strange quark changes to a charm quark

24) Over an entire lifetime, the average person will receive a cumulative radiation exposure of less than 20 rems. Most of this comes from.

- A) nuclear power plants.
- B) fallout from nuclear weapons testing.
- C) medicine and diagnostic procedures (e.g. X-rays).
- D) natural background (e.g. cosmic radiation).
- E) consumer products (e.g. smoke detectors containing americium-241).

25) What amount of radiation would be lethal to half of a population (LD<sub>50</sub>) that received it as an acute (short-term) exposure?

- A) 25 rems                      B) 50 rems                      C) 100 rems                      D) 250 rems                      E) 500rem