

Period 17 Exercise Answers

E.1 The appeal of using nuclear energy to generate electricity comes mainly from the fact that

- a) typical binding energies in nuclei are about a million times greater than the binding energies between atoms and molecules.
- b) the fissionable isotope U-238 is common in most rocks.
- c) operating reactors do not have any harmful byproducts.
- d) reactors make radioactive nuclei for use in the treatment of cancer.
- e) the storage of radioactive waste is no longer a problem.

E.1 = a

E.2 The function of the moderator in a nuclear reactor is to

- a) absorb slow neutrons to control the reaction.
- b) reduce the speed of neutrons to allow a chain reaction to occur.
- c) combine with the core in case of meltdown.
- d) carry heat away from the core.
- e) absorb radiation to protect the workers from radiation damage.

E.2 = b

E.3 The purpose of the control rods in a nuclear reactor is

- a) to serve as a catalyst that controls the rate of the reaction.
- b) to slow down neutrons to energies appropriate for inducing fission in U-235.
- c) to supply the activation energy to start the reactor.
- d) to absorb neutrons and control the rate at which the fission reaction occurs.
- e) to cool the uranium as it fissions.

E.3 = d

E.4 Which of the following is not a component of a breeder nuclear reactor?

- a) fuel rods
- b) moderator
- c) control rods
- d) coolant
- e) containment system

E.4 = b

E.5 How much energy is stored in 0.5 kg of antiprotons and 0.5 kg of protons?

- a) 1.0 J
- b) 1.5×10^8 J
- c) 3.0×10^8 J
- d) 2.5×10^{15} J
- e) 9.0×10^{16} J

All particles have antiparticles. When a particle and its antiparticle meet, they annihilate each other. All of their matter is converted into energy.

$$E = M c^2 = (0.5 \text{ kg} + 0.5 \text{ kg}) \times (3 \times 10^8 \text{ m/s})^2$$

$$E = 1 \text{ kg} \times (9 \times 10^{16} \text{ m}^2/\text{s}^2) = 9 \times 10^{16} \text{ J}$$

E.5 = e

Period 17 Answers

$$\mathbf{E.1 = a}$$

$$\mathbf{E.2 = b}$$

$$\mathbf{E.3 = d}$$

$$\mathbf{E.4 = b}$$

$$\mathbf{E.5 = e}$$