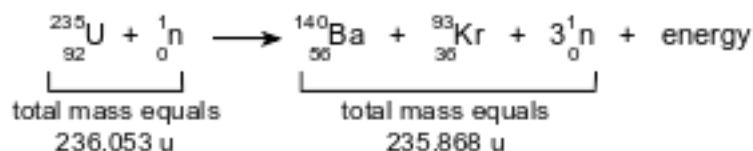


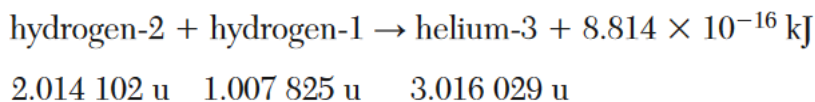
## Nuclear Energy

1 Given the equation representing a reaction:



Which statement explains the energy term in this reaction?

- (1) Mass is gained due to the conversion of mass to energy.
  - (2) Mass is gained due to the conversion of energy to mass.
  - (3) Mass is lost due to the conversion of mass to energy.
  - (4) Mass is lost due to the conversion of energy to mass.
- 2 The energy released by a nuclear fusion reaction is produced when
- (1) energy is converted to mass
  - (2) mass is converted to energy
  - (3) heat is converted to temperature
  - (4) temperature is converted to heat
- 3 The energy released during a nuclear reaction is a result of
- (1) breaking chemical bonds
  - (2) forming chemical bonds
  - (3) mass being converted to energy
  - (4) energy being converted to mass
- 4 Which process converts mass into energy?
- (1) distillation of ethanol
  - (2) filtration of a mixture
  - (3) fusion of hydrogen atoms
  - (4) ionization of cesium atoms
- 5 Which change occurs during a nuclear fission reaction?
- (1) Covalent bonds are converted to ionic bonds.
  - (2) Isotopes are converted to isomers.
  - (3) Temperature is converted to mass.
  - (4) Matter is converted to energy.
- 6 Which net change occurs in a nuclear fusion reaction?
- (1) Ionic bonds are broken.
  - (2) Ionic bonds are formed.
  - (3) Energy is converted to mass.
  - (4) Mass is converted to energy.
- 7 Given the equation representing a reaction where the masses are expressed in atomic mass units:



Which phrase describes this reaction?

- (1) a chemical reaction and mass being converted to energy
- (2) a chemical reaction and energy being converted to mass
- (3) a nuclear reaction and mass being converted to energy
- (4) a nuclear reaction and energy being converted to mass

- 8 During a nuclear reaction, mass is converted into
- |            |             |
|------------|-------------|
| (1) charge | (3) isomers |
| (2) energy | (4) volume  |

- 9 Given the balanced equation representing a nuclear reaction:



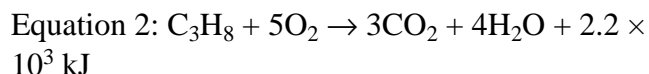
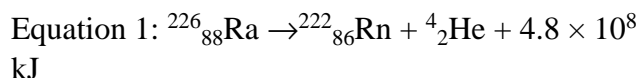
Which phrase identifies and describes this reaction?

- |                                       |
|---------------------------------------|
| (1) fission, mass converted to energy |
| (2) fission, energy converted to mass |
| (3) fusion, mass converted to energy  |
| (4) fusion, energy converted to mass  |
- 10 Which statement describes a benefit of using fission reactions?
- |  |
|--|
| (1) Radioactive waste must be stored for long periods of time. |
| (2) Nuclear fuel consists of stable isotopes.                  |
| (3) Gamma radiation is produced.                               |
| (4) Large amounts of energy are produced per mole of reactant. |
- 11 Using equal masses of reactants, which statement describes the relative amounts of energy released during a chemical reaction and a nuclear reaction?
- |   |
|---|
| (1) The chemical and nuclear reactions release equal amounts of energy.               |
| (2) The nuclear reaction releases half the amount of energy of the chemical reaction. |
| (3) The chemical reaction releases more energy than the nuclear reaction.             |
| (4) The nuclear reaction releases more energy than the chemical reaction.             |

- 12 Compared to the energy released per mole of reactant during chemical reactions, the energy released per mole of reactant during nuclear reactions is

- |                  |                      |
|------------------|----------------------|
| (1) much less    | (3) slightly less    |
| (2) much greater | (4) slightly greater |

- 13 Given two balanced equations, each representing a reaction:



Which statement compares the energy terms in these two equations?

- |  |
|--|
| (1) Equation 1 shows $2.2 \times 10^5$ times more energy being absorbed. |
| (2) Equation 2 shows $2.2 \times 10^5$ times more energy being absorbed. |
| (3) Equation 1 shows $2.2 \times 10^5$ times more energy being released. |
| (4) Equation 2 shows $2.2 \times 10^5$ times more energy being released. |
- 14 Which reaction releases the greatest amount of energy per mole of reactant?
- |                    |                  |
|--------------------|------------------|
| (1) decomposition  | (3) fermentation |
| (2) esterification | (4) fission      |

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

A breeder reactor is one type of nuclear reactor. In a breeder reactor, uranium-238 is transformed in a series of nuclear reactions into plutonium-239.

The plutonium-239 can undergo fission as shown in the equation below. The X represents a missing product in the equation.



- 15 Compare the amount of energy released by 1 mole of completely fissioned plutonium-239 to the amount of energy released by the complete combustion of 1 mole of methane.

## Answer Keys

1 3

2 2

3 3

4 3

5 4

6 4

7 3

8 2

9 3

10 4

11 4

12 2

13 3

14 4

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

- The fission of one mole of Pu-239 releases much more energy than the combustion of one mole of CH<sub>4</sub>.
- The energy released during the chemical reaction is less than the energy released during the nuclear reaction.
- greater for  $^{239}_{94}\text{Pu}$