1. What occurs in both fusion and fission reactions?

   A) Small amounts of energy are converted into large amounts of matter.
   B) Small amounts of matter are converted into large amounts of energy.
   C) Heavy nuclei are split into lighter nuclei.
   D) Light nuclei are combined into heavier nuclei.

2. Which statement best describes what happens in a fission reaction?

   A) Heavy nuclei split into lighter nuclei.
   B) Light nuclei form into heavier nuclei.
   C) Energy is released and less stable elements are formed.
   D) Energy is absorbed and more stable elements are formed.

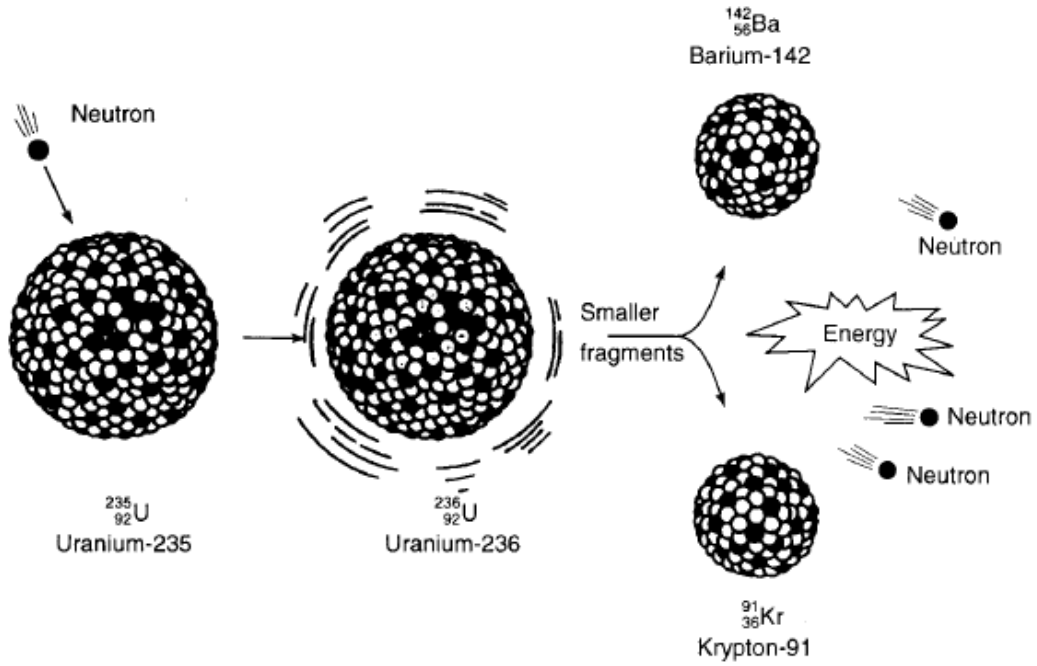
3. Which balanced equation represents nuclear fusion?

   A) ${}^{3}_{1}\mathrm{H} \rightarrow {}^{3}_{2}\mathrm{He} + {}^{0}_{-1}\mathrm{e}$
   B) ${}^{235}_{92}\mathrm{U} \rightarrow {}^{231}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He}$
   C) ${}^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He}$
   D) ${}^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{90}_{38}\mathrm{Sr} + {}^{143}_{54}\mathrm{Xe} + 3{}^{1}_{0}\mathrm{n}$

4. In which reaction is mass converted to energy by the process of fission?

   A) ${}^{14}_{7}\mathrm{N} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{14}_{6}\mathrm{C} + {}^{1}_{1}\mathrm{H}$
   B) ${}^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{87}_{35}\mathrm{Br} + {}^{146}_{57}\mathrm{La} + 3\,{}^{1}_{0}\mathrm{n}$
   C) ${}^{226}_{88}\mathrm{Ra} \rightarrow {}^{222}_{86}\mathrm{Ra} + {}^{4}_{2}\mathrm{He}$
   D) ${}^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He}$

5. The diagram below represents a nuclear reaction in which a neutron bombards a heavy nucleus.



Which type of reaction does the diagram illustrate?

A) fission B) fusion C) alpha decay D) beta decay

6. Which equation represents nuclear fusion?

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

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

C) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{139}_{56}Ba + {}^{94}_{36}Kr + 3\ {}^{1}_{0}n$

D) $^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$

7. Which pair of nuclei can undergo a fusion reaction?

A) potassium-40 and cadmium-113
B) zinc-64 and calcium-44
C) uranium-238 and lead-208
D) hydrogen-2 and hydrogen-3

8. Compared to an ordinary chemical reaction, a fission reaction will

A) release smaller amounts of energy
B) release larger amounts of energy
C) absorb smaller amounts of energy
D) absorb larger amounts of energy

9. Which term identifies a type of nuclear reaction?

A) fermentation B) deposition
C) reduction D) fission

10. Given the balanced equation representing a nuclear reaction:

$$^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$$

Which phrase identifies and describes this reaction?

A) fission, mass converted to energy
B) fission, energy converted to mass
C) fusion, mass converted to energy
D) fusion, energy converted to mass

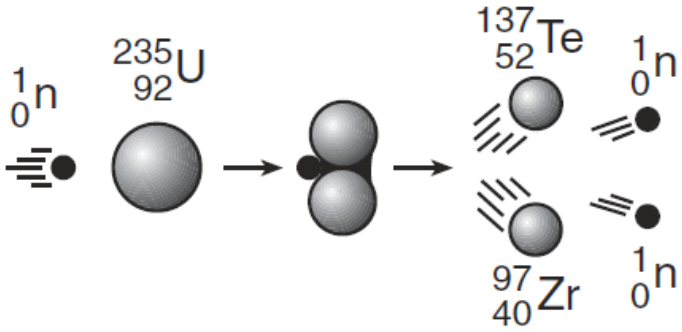
11. Which substance has *chemical* properties similar to those of radioactive ^{235}U?

A) ^{235}Pa B) ^{233}Pa C) ^{233}U D) ^{206}Pb

12. Which reaction releases the greatest amount of energy per mole of reactant?

A) decomposition B) esterification
C) fermentation D) fission

13. Given the diagram representing a reaction:



Which phrase best describes this type of reaction and the overall energy change that occurs?

A) nuclear, and energy is released
B) nuclear, and energy is absorbed
C) chemical, and energy is released
D) chemical, and energy is absorbed

14. Which balanced equation represents nuclear fusion?

A) $^{1}_{0}\mathrm{n} + {}^{235}_{92}\mathrm{U} \rightarrow {}^{142}_{56}\mathrm{Ba} + {}^{91}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n}$
B) $^{226}_{88}\mathrm{Ra} \rightarrow {}^{222}_{86}\mathrm{Rn} + {}^{4}_{2}\mathrm{He}$
C) $^{6}_{3}\mathrm{Li} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{3}_{1}\mathrm{H} + {}^{4}_{2}\mathrm{He}$
D) $^{2}_{1}\mathrm{H} + {}^{3}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n}$

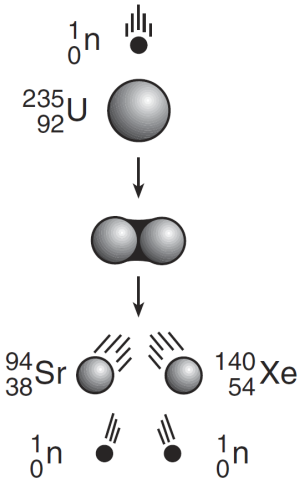
15. An uncontrolled chain reaction takes place during the

A) operation of a fission nuclear reactor
B) explosion of an atomic bomb
C) production of energy by the Earth's Sun
D) fusion of light nuclei into heavier nuclei

16. In which type of reaction do two lighter nuclei combine to form one heavier nucleus?

A) combustion
B) reduction
C) nuclear fission
D) nuclear fusion

17. Given the diagram representing a reaction:



Which type of change is represented?

A) fission
B) fusion
C) deposition
D) evaporation

18. Which statement best describes a primary occurrence in an uncontrolled fission reaction?

A) Mass is created and energy is released.
B) Mass is created and energy is stored.
C) Mass is converted to energy, which is released.
D) Mass is converted to energy, which is stored.

19. Given the nuclear reaction:

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

This equation can best be described as

A) fission
B) fusion
C) natural decay
D) endothermic

20. When a uranium nucleus breaks up into fragments, which type of nuclear reaction occurs?

A) fusion
B) fission
C) replacement
D) redox

21. Which balanced equation represents nuclear fusion?

A) $^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He}$
B) $2\mathrm{H_2} + \mathrm{O_2} \rightarrow 2\mathrm{H_2O}$
C) $^{6}_{3}\mathrm{Li} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{3}_{1}\mathrm{H} + {}^{4}_{2}\mathrm{He}$
D) $\mathrm{CaO} + \mathrm{CO_2} \rightarrow \mathrm{CaCO_2}$

22. Which equation represents a fusion reaction?

A) $H_2O(g) \rightarrow H_2O(\ell)$
B) $C(s) + O_2(g) \rightarrow CO_2(g)$
C) ${}^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$
D) ${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3\ {}^{1}_{0}n$

23. Given the balanced equation representing a nuclear reaction:

$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3X + \text{energy}$

Which particle is represented by X?

A) ${}^{0}_{-1}e$ B) ${}^{1}_{1}H$ C) ${}^{4}_{2}H$ D) ${}^{1}_{0}n$

24. What is the primary result of a fission reaction?

A) conversion of mass to energy
B) conversion of energy to mass
C) binding together of two heavy nuclei
D) binding together of two light nuclei

25. In the fusion reaction:

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

The X represents

A) a released electron
B) another neutron
C) energy converted from mass
D) mass converted from energy

26. What is one benefit associated with a nuclear fission reaction?

A) The products are not radioactive.
B) Stable isotopes are used as reactants.
C) There is no chance of biological exposure.
D) A large amount of energy is produced.

27. Which equation represents a fusion reaction?

A) ${}^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{4}_{2}He$
B) ${}^{14}_{6}C \rightarrow {}^{0}_{-1}e + {}^{14}_{7}N$
C) ${}^{238}_{92}U + {}^{4}_{2}He \rightarrow {}^{241}_{94}Pu + {}^{1}_{0}n$
D) ${}^{1}_{0}n + {}^{27}_{13}Al \rightarrow {}^{24}_{11}Na + {}^{4}_{2}He$

28. When a nucleus with a high mass undergoes fission, the resulting nuclei are more stable than the original nucleus because they have a

A) higher binding energy per nucleon
B) lower binding energy per nucleon
C) higher number of electrons
D) lower number of electrons

29. Which change takes place in a nuclear fusion reaction?

A) Matter is converted to energy.
B) Energy is converted to matter.
C) Ionic bonds are converted to covalent bonds.
D) Covalent bonds are converted to ionic bonds.

30. A nuclear reaction in which two light nuclei combine to form a more massive nucleus is called

A) addition B) fission
C) fusion D) substitution

31. Nuclear fusion *differs* from nuclear fission because nuclear fusion reactions

A) form heavier isotopes from lighter isotopes
B) form lighter isotopes from heavier isotopes
C) convert mass to energy
D) convert energy to mass

32. Which balanced equation represents a fusion reaction?

A) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{93}_{36}Kr + {}^{140}_{56}Ba + 3\,{}^{1}_{0}n$
B) ${}^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n$
C) ${}^{14}_{7}N + {}^{4}_{2}He \rightarrow {}^{17}_{8}O + {}^{1}_{1}H$
D) $^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}He$

33. High energy is a requirement for fusion reactions to occur because the nuclei involved

A) attract each other because they have like charges
B) attract each other because they have unlike charges
C) repel each other because they have like charges
D) repel each other because they have unlike charges