

תידון המדע הירושלמי תשס"ח - Jerusalem Science Contest 2008-2009
Electromagnetic and Ionizing radiation
Exam 11 — Chapter 34 -Nuclear Fission and Fusion

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) The measure of how efficiently the nucleus of an isotope of any element will either absorb or scatter a neutron upon collision with it is called the
 - A) neutron effective area
 - B) neutron cross section
 - C) nuclear absorption coefficient
 - D) nuclear collision constant
 - E) none of the preceding

- 2) Which of the following reactions will result in the production of neutrons?
 - A) irradiating lead-206 with beta particles from Cs-137
 - B) irradiating uranium -235 with alpha particles from americium-241
 - C) irradiating beryllium-9 with alpha particles from polonium-209
 - D) all of the preceding
 - E) none of the preceding.

- 3) Which of the following are fissionable isotopes of the element uranium?
 - A) U-233
 - B) U-235
 - C) U-238
 - D) all of the preceding
 - E) none of the preceding

- 4) Which of the following isotopes could be used to make a nuclear weapon (without further transmutation) ?
 - A) Th-232
 - B) U-238
 - C) Pu-239
 - D) all of the preceding
 - E) none of the preceding

- 5) How many neutrons are released by the fissioning of one atom of U-235 into an atom of Kr-91 and Ba-142? (Kr and Ba have atomic numbers of 36 and 56, respectively; U has an atomic number of 92).
 - A) one
 - B) two
 - C) three
 - D) four
 - E) five

- 6) The amount of U-235 present in naturally occurring uranium is about
 - A) 0.05%
 - B) 0.7%
 - C) 1.6%
 - D) 2.5%
 - E) 5.0%

- 7) The force that must be overcome in order for fission to occur is
- A) the electromagnetic force.
 - B) the weak force.
 - C) the strong force.
 - D) the gravitational force.
 - E) all of the preceding must be overcome
- 8) In addition to mass, geometry is important in determining whether or not sustained fission will occur. For objects of the same mass
- A) a low surface area to volume ratio is more favorable for sustained fission.
 - B) a high surface area to volume ratio is more favorable for sustained fission.
 - C) neither a high nor a low surface area to volume ratio is favorable, but an intermediate value is favorable.
 - D) surface area to volume is not important, only the shape.
 - E) none of the preceding.
- 9) The percentage of U-235 in reactor grade uranium fuel is approximately
- A) 0.5%.
 - B) 1.0%.
 - C) 2.5%.
 - D) 10%.
 - E) 90%.
- 10) The percentage of U-235 in weapons grade uranium is about
- A) 10%.
 - B) 25%.
 - C) 50%.
 - D) 65%.
 - E) 90%.
- 11) Which of the following methods have been used to obtain enriched uranium?
- A) fractional distillation
 - B) fractional crystallization
 - C) electrophoresis
 - D) gaseous diffusion or effusion
 - E) liquid chromatography
- 12) Approximately how much plutonium is required to make an atomic bomb, if no tamper is used?
- A) 500 g
 - B) 1.5 kg
 - C) 5 kg
 - D) 7.5 kg
 - E) 10 kg
- 13) Fast neutrons can be slowed to thermal neutrons by passing them through certain materials known as
- A) converters.
 - B) moderators.
 - C) modulators.
 - D) inverters.
 - E) none of the preceding.
- 14) The first man-made self-sustained nuclear chain reaction was initiated at
- A) the University of Chicago.
 - B) Stanford University.
 - C) the University of California at Berkeley.
 - D) the Trinity site, Alamogordo, NM.
 - E) MIT.

- 15) The uranium compound that is used to separate U-235 from U-238 is
- A) UO_2 .
 - B) UO_3 .
 - C) $\text{UO}_2(\text{NO}_3)_2$.
 - D) UF_6 .
 - E) none of the preceding.
- 16) U-238 is converted into a fissile material in what kind of a nuclear reactor?
- A) fission reactor
 - B) fusion reactor
 - C) breeder reactor
 - D) heavy water reactor
 - E) none of the preceding
- 17) Neutron bombardment of U-238 resulted in the production of the first man-made transuranium element. Which element is it?
- A) protactinium-239
 - B) neptunium-239
 - C) plutonium-239
 - D) americium-239
 - E) none of the preceding
- 18) In a nuclear reaction, mass is converted to energy. The mass equal to the nuclear binding energy released is known as the
- A) mass defect
 - B) mass deficit
 - C) mass equivalence
 - D) Einstein factor
 - E) Fermi constant
- 19) Fusion reactions are more efficient than fission reactions. The amount of mass converted to energy in a fission reaction is about 0.1%. In a fusion reaction it is about
- A) 0.25%. B) 0.5%. C) 0.7%. D) 5%. E) 50%.
- 20) The explosive yield of the atomic bombs dropped on Hiroshima and Nagasaki, Japan were equivalent to about 15 kilotons of TNT. The largest H-bomb ever exploded has a yield of about
- A) 50 kilotons. B) 500 kilotons. C) 1 megaton. D) 20 megatons. E) 50 megatons.
- 21) Which of the following fusion reactions will produce the greatest energy?
- A) fusion of protium and deuterium
 - B) fusion of protium and tritium
 - C) fusion of deuterium and deuterium
 - D) fusion of deuterium and tritium
 - E) none of the preceding - they all have the same yield.

- 22) The "trigger" for a hydrogen bomb is a
- A) plasma discharge
 - B) pulsed nanosecond laser
 - C) thermite reaction
 - D) atomic bomb
 - E) none of the preceding
- 23) At what temperature does a fusion reaction produce enough energy to be self-sustaining?
- A) 1 million K
 - B) 10 million K
 - C) 35 million K
 - D) 350 million K
 - E) 1 billion K
- 24) The material used as fuel for fusion experiments today is
- A) deuterium
 - B) tritium
 - C) a mixture of deuterium and tritium
 - D) lithium hydride
 - E) lithium deuteride
- 25) The individual generally credited as being the "father of the hydrogen bomb" is
- A) Alber Einstein
 - B) Edward Teller
 - C) Enrico Fermi
 - D) Robert Openheimer
 - E) Niels Bohr