

Last Name: \_\_\_\_\_ First Name \_\_\_\_\_ Network-ID \_\_\_\_\_

Writing Lab Section: \_\_\_\_\_ Writing Lab TA Name: \_\_\_\_\_

**Turn off your cell phone and put it out of sight.**

**Calculators cannot be used.**

**This is a closed book exam. You have 180 minutes to complete it.**

1. Use a #2 pencil. Do not use a mechanical pencil or pen. Darken each circle completely, but stay within the boundary. If you decide to change an answer, erase vigorously; the scanner sometimes registers incompletely erased marks as intended answers; this can adversely affect your grade. Light marks or marks extending outside the circle may be read improperly by the scanner. Be especially careful that your mark covers the **center** of its circle.
2. **This Exam Booklet is Version A.** Mark the **A** circle in the **TEST FORM** box near the middle of your answer sheet. **DO THIS NOW!**
3. Print your **NETWORK ID** in the designated spaces at the *right* side of the answer sheet, starting in the left most column, then **mark the corresponding circle** below each character. If there is a letter "o" in your NetID, be sure to mark the "o" circle and not the circle for the digit zero. If and only if there is a hyphen "-" in your NetID, mark the hyphen circle at the bottom of the column. When you have finished marking the circles corresponding to your NetID, check particularly that you have not marked two circles in any one of the columns.
4. Print **YOUR LAST NAME** in the designated spaces at the *left* side of the answer sheet, then mark the corresponding circle below each letter. Do the same for your **FIRST NAME INITIAL**.
5. Do not write in or mark the circles in any of the other boxes (STUDENT NUMBER, DATE, SECTION, SCORES, SPECIAL CODE).
6. Sign your name (**DO NOT PRINT**) on the **STUDENT SIGNATURE line**.
7. On the **SECTION line**, print your **Writing Lab Section**. You need not fill in the COURSE or INSTRUCTOR lines.

*Before starting work, check to make sure that your test booklet is complete. You should have 28 numbered pages.*

**Academic Integrity—Giving assistance to or receiving assistance from another student or using unauthorized materials during a University Examination can be grounds for disciplinary action, up to and including dismissal from the University.**

*Exam Grading Policy—*

The exam is composed of 120 questions, there are 5 different types of questions.

**Rules for different problem types and partial credit:**

**A) Problems with multiple correct answer:** *multiple-choice-five (or four)-answer questions, each worth six (or four) points.*

There will be no partial credit for problems with multiple correct answers. **These problems are marked as multiple correct answer problems and all correct answers need to be marked correctly on the answer sheet in order to obtain credit.**

**B) MC5:** *multiple-choice-five-answer questions, each worth 6 points.*  
**Partial credit will be granted as follows.**

- (a) If you mark only one answer and it is the correct answer, you earn **6** points.
- (b) If you mark *two* answers, one of which is the correct answer, you earn **3** points.
- (c) If you mark *three* answers, one of which is the correct answer, you earn **2** points.
- (d) If you mark no answers or the wrong answer, or more than *three*, you earn **0** points.

**C) MC4:** *multiple-choice-four-answer questions, each worth 4 points.*  
**Partial credit will be granted as follows.**

- (a) If you mark only one answer and it is the correct answer, you earn **4** points.
- (b) If you mark *two* answers, one of which is the correct answer, you earn **2** points.
- (c) If you mark a wrong answer or no answers or more than two, you earn **0** points.

**D) MC3:** *multiple-choice-three-answer questions, each worth 3 points.*  
**No partial credit.**

- (a) If you mark only one answer and it is the correct answer, you earn **3** points.
- (b) If you mark a wrong answer or no answers, you earn **0** points.

**E) MC2:** *multiple-choice-two-answer questions, each worth 2 points.*  
**No partial credit.**

- (a) If you mark only one answer and it is the correct answer, you earn **2** points.
- (b) If you mark the wrong answer or neither answer, you earn **0** points

## A. Nuclear Physics

1) Breeding plutonium can best be described as:

- A. Extracting tiny amounts of plutonium from iron ore and enriching to higher concentrations using gas centrifuges.
- B. Bombarding uranium with neutrons in a special reactor to create plutonium atoms.
- C. Heating uranium ore to high temperatures and reacting with proton-rich tributyl phosphate.

2) A team of scientists from Greendale Community College announced that they have invented a fusion reactor designed to fuse lead atoms to power their campus. Why would this be impossible?

- A. It is physically impossible to fuse lead atoms since all of leads isotopes are non-radioactive.
- B. Fusing atoms heavier than iron actually leads to a net loss of energy, so it would be impossible to make electricity with lead fusion.
- C. Elements heavier than iron are extremely difficult to ionize, and the plasmas required to fuse elements require 100% ionization.

3) IAEA inspectors have arrived at a nuclear facility in the Republic of Sokovia for a routine inspection. The video feed taken before the arrival of the inspectors shows the Sokovians dismantling what appears to be an old Soviet plutonium implosion weapon and placing the plutonium pit into a lead box, but it is rumored that they sold the plutonium to the terrorist organization HYDRA and replaced the pit with nuclear waste from Chernobyl. Which of the following methods would be **INEFFECTIVE** at verifying that the material in the box is actually the Soviet *weapons-grade plutonium*?

- A. The inspectors scrape a piece of the material and verify using chemical methods that the material is plutonium.
- B. Using a suitable radiation detector and a rough estimate of the amount of plutonium-239 that should be in the box, the inspectors verify the expected amount of radiation at the energy levels emitted by Pu-239.
- C. Using a radiation detector, the inspectors detect a large amount of radiation coming from inside the box.
- D. Subtracting the mass of the lead box, the inspectors weigh the radioactive material and determine that the fifteen kilogram mass of the plutonium pit is accounted for.
- E. Inspectors run a sample of the material through a mass spectrometer and observe that 95% of the material has an atomic weight of 239 and 5% has a weight of 240.

4) Uranium-235 and uranium-238:

- A. Have the same number of neutrons and a different number of protons.
- B. Have the same number of protons and a different number of neutrons.
- C. Have the same number of protons and a different number of electrons.
- D. Have the same number of electrons and a different number of protons.

5) Which force holds the nucleus of an atom together, overcoming the electromagnetic repulsion of the positively-charged protons?

- A. Weak nuclear force
- B. Strong nuclear force
- C. Gravitational force
- D. Antigravitational force

6) Which of the following methods can be employed to produce tritium for hydrogen bombs?

- A. Tritium is found naturally in ocean water; about 1 in 6500 hydrogen atoms in water are tritium. Extracting it from ocean water is relatively easy.
- B. Tritium can be produced industrially or “stored” as lithium-6 until a weapon is used. [When a lithium-6 nucleus absorbs a neutron, it fissions into helium and tritium nuclei.]
- C. Tritium is given off as a decay product of cesium-137, which is easily extractable from spent nuclear reactor fuel.

7) Uranium is the heaviest of the 91 isotopes found in nature, but is actually the 92<sup>nd</sup> element. Which of the following light elements is not found in nature?

- A. Gallium
- B. Molybdenum
- C. Technetium
- D. Thallium

8) A nuclide that can become fissile by absorbing a neutron is:

- A. Fissile
- B. Fissionable but not fissile
- C. Fertile

9) A nuclide that fissions only with neutrons of sufficient energy is:

- A. Fissile
- B. Fissionable but not fissile
- C. Fertile

10) Gamma radiation is best described as:

- A. Emission of a helium nucleus with a charge of +2.
- B. Emission of a beta-positron “twinned” pair.
- C. Emission of a high-energy photon.
- D. Emission of a neutron at low energies.

## B. Nuclear weapons

11-15) Match the following:

The following table will be used for questions 11-15. The table lists 5 categories of nuclear explosive materials. Each row in the table corresponds to one question, 12-16. The 1<sup>st</sup> column lists for each questions the name of category of nuclear explosive materials. The 2<sup>nd</sup> column contains the required percentage of the material for that category. On your answer sheet bubble for each question the matching answer key from the 2<sup>nd</sup> column. **[2 points each]**

11. LEU	A. 80-93% Pu239
12. Weapons grade HEU	B. <20% U235
13. Weapons grade Plutonium	C. >93% Pu239
14. Reactor grade Plutonium	D. <80% Pu239
15. Fuel grade Plutonium	E. >80% U235

16.) Which of the following statements best describes the role of the high explosive lenses in an implosion-type fission weapon?

- A. The lenses redirect neutrons from the outside of the bomb to the inside.
- B. The lenses reflect neutrons emitted from the nuclear material which would otherwise escape from the bomb.
- C. The lenses protect the NEM, which is initially in a subcritical state, from accidentally going supercritical by shielding the NEM from stray neutrons
- D. The lenses focus the outgoing gamma rays to increase the yield of the weapon.
- E. The lens configuration of high speed conventional explosives produces a converging spherical blast wave, which will compress the NEM.

17.) Which of the following statements best describes why gaseous diffusion isotope separation is **not** the preferred isotope separation technique? **[Mark all correct answers.]**

- A. Gaseous diffusion is costly.
- B. Gaseous diffusion is very inefficient, requiring many stages.
- C. Gaseous diffusion is technically complex and hard to get right.
- D. Gaseous diffusion is unpredictable.

18.) What is the distinguishing feature of uranium isotopes used by molecular laser isotope separation?

- A. The difference in the mass of U-235 and U-238.
- B. The different charge to mass ratio of U-235 and U-238.
- C. Differences in molecular energy levels of uranium hexafluoride for U-235 vs. U-238.
- D. The different number of electrons in U-235 vs. U-238.
- E. The different physical size of uranium hexafluoride with U-235 vs. U-238.

19.) A neutron bomb is a type of tactical thermonuclear weapon specifically designed to release a large portion of its energy as energetic neutron radiation. Which of the following statements best describes the major alteration that a neutron bomb makes to a normal two-stage (P280) weapon discussed in class?

- A. The neutron bomb, in contrast to the P280 design, has no primary stage; thus, all the energy comes from the fusion secondary stage.
- B. The neutron bomb has a tertiary stage that absorbs the alpha particles produced in the secondary stage to produce highly energetic neutrons.
- C. The neutron bomb, in contrast to the P280 design, does not have a heavy depleted uranium (DU) shell, rather it has an extremely thin casing allowing many energetic neutrons to escape.
- D. The neutron bomb, in contrast to the P280 design, has a Pu-240 shell, using its high number of spontaneous neutrons to its advantage.

20.) South Africa produced and successfully tested a handful of gun-type fission weapons in the 1980s. Many believe that South Africa developed these weapons for purely political rather than military reasons, i.e. to use their existence as leverage for negotiations to end the war with Angola. Assuming this to be true, what is the most likely reason they chose the gun-type fission design?

- A. A gun-type weapon has the capacity for the highest yield out of all the nuclear weapon designs.
- B. A gun-type weapon is the most straightforward design, and thus the simplest to learn how to create.
- C. An implosion-type weapon is extremely difficult to conceal.
- D. A gun-type weapon is the most complicated design, and thus would show South Africa's mastery of weapon technology.
- E. Angola might not believe South Africa if they claimed they had an implosion-type device.

### C. Nuclear Explosions

21.) *Mark each* factor that determines the seriousness of a burn injury after a nuclear explosion.

**[Mark all correct answers.]**

- A. Total energy released
- B. Transparency of atmosphere
- C. Whether the person is inside a building or not
- D. The slant distance of the burst to the person
- E. What the person is wearing

22.) The correct order in which the effects from a large airburst are felt are:

- A. Thermal radiation, EMP, blast wave, fallout
- B. Fallout, blast wave, thermal radiation, EMP
- C. EMP, thermal radiation, blast wave, fallout
- D. EMP, blast wave, thermal radiation, fallout
- E. Blast wave, thermal radiation, EMP, fallout

23.) True or false: A nuclear weapon has never been detonated in space.

- A. True
- B. False

- 24.) If a nuclear weapon were detonated in space, which nuclear weapon effect would cause the most damage to satellites at significant distances from the location of the explosion?
- A. EMP
  - B. Blast wave
  - C. Thermal radiation
  - D. Fallout
- 25.) When the energy released by a nuclear explosion is stated in “kilotons”, what other explosive material is it being compared to?
- A. Fireworks
  - B. TNT
  - C. Nitroglycerin
  - D. Napalm
- 26.) Geologists in the United States detected unusual seismic activity in North Korea. They also detected traces of noble gasses in the air over North Korea, but no radioactive fallout is present. Is it likely that North Korea tested a nuclear weapon, and if so, which type of burst did they use?
- A. Yes, North Korea tested a weapon using a surface burst.
  - B. Yes, North Korea tested a weapon using a partially contained underground burst.
  - C. Yes, North Korea tested a weapon using a fully contained underground burst.
  - D. Yes, North Korea tested a weapon using an underwater burst.
  - E. No, North Korea did not test a nuclear weapon.
- 27.) If the fireball from a nuclear explosion touches the ground, which blast effect increases?
- A. The blast wave
  - B. The thermal radiation
  - C. The EMP
  - D. The radioactive fallout
- 28.) Which year saw the most nuclear explosions worldwide?
- A. 1945
  - B. 1956
  - C. 1962
  - D. 1977
  - E. 2000



- 29.) Which effect of a nuclear air burst carries the largest fraction of total energy?
- A. EMP
  - B. Thermal Radiation
  - C. Prompt nuclear radiation
  - D. Residual fallout
  - E. Blast wave
- 30.) A SORT war between Russia and the United States could generate 200 teragrams of soot which would effectively reduce the average temperature by \_\_\_\_\_°F and reduce precipitation by \_\_\_\_\_%
- A. 14°F, 45%
  - B. 25°F, 65%
  - C. 5°F, 20%
  - D. 10°F, 35%
  - E. There would be no effect on temperature or precipitation.

#### **D. Terrorism**

- 31.) Which of the following is the definition of state terrorism?
- A. The state sponsorship of terrorist acts against inhabitants of other countries as an instrument of foreign policy.
  - B. The use of terrorism by a government against its own citizens, to coerce them into accepting the government's authority.
  - C. The use of terrorism by a government against the civilians of another country with which it is at war.
  - D. The sponsorship of terrorist acts by a private organization that is not recognized as a nation by the rest of the international community.
- 32.) Which of the following are *not* one of the "Three No's" that Allison formulates in his doctrine in order to deny terrorists access to nuclear weapons or materials?
- A. No loose nukes
  - B. No new nascent nukes
  - C. No new nuclear material
  - D. No new nuclear weapon states

- 33.) Which of the following is a problem that terrorist organizations wishing to construct a nuclear explosive would confront? **[Mark all correct answers.]**
- A. Assembling a team of technical personnel.
  - B. Substantial financial costs.
  - C. Radiation and chemical hazards.
  - D. Acquisition of nuclear-explosive material.
- 34.) Which of the following is the most effective way to prevent nuclear terrorism?
- A. Denying terrorists access to nuclear weapons or materials.
  - B. Deploying air strikes targeting suspected terrorist locations to wipe out any affiliates.
  - C. Helping the communities by increasing trade in hopes of preventing the need for terrorist actions.
  - D. Calling upon other nations to increase their counterterrorism measures.
- 35.) Richardson argues that there are six basic rules for containing terrorism. Which of the following are some of these rules? **[Mark all correct answers.]**
- A. Have a defensible and achievable goal.
  - B. Separate the terrorists from their communities.
  - C. Engage in covert military action.
  - D. Know your enemy.
  - E. .Have patience and keep your perspective.
- 36.) Which of the following is not a defining characteristic of terrorism?
- A. The violence must be against civilians.
  - B. The violence must be deliberate.
  - C. The violence must have a political purpose.
  - D. The individual victims must be randomly chosen.
  - E. The act must be violent or threaten violence.
- 37.) According to Richardson, terrorists act with 3 immediate objectives (the “3 Rs”) in mind, what are they?
- A. Revenge
  - B. Resources
  - C. Renown
  - D. Reaction

- 38.) What is the definition of nuclear forensics?
- A. Scientific tests or techniques used in connection with the detection of crime.
  - B. The analysis of intercepted illicit nuclear or radioactive material and any associated material to provide evidence for nuclear attribution.
  - C. The study of the physics of atomic nuclei and their interactions, especially in the generation of nuclear energy.
- 39.) Which of the following are known terrorist organizations that have sought nuclear weapons or weapon materials? **[Mark all correct answers.]**
- A. Al-Qaeda
  - B. Jemaah Islamiyah
  - C. Chechnyan Separatists
  - D. Hezbollah
- 40.) Richardson argues that the declaration of a “global war on terror” has been a mistake and is likely to fail. She argues for different approaches, which *TWO* of these approaches did she suggest?
- A. Increase counterterrorist initiatives and engage in more clandestine operations.
  - B. Appreciate the factors driving the terrorists.
  - C. Attack towns and cities that are known to contain terrorist cells.
  - D. Deprive them of what they need.

#### **D. Nuclear Weapon Delivery Methods**

- 41) What were the three legs of the Cold War nuclear “Triad”?
- A. Surface-ship-launched ballistic missiles, land-based ICBMs, bombers.
  - B. Submarine-launched ballistic missiles, land-based ICBMs, Sea based cruise missiles.
  - C. Submarine-launched ballistic missiles, land-based ICBMs, bombers.
  - D. Surface-ship-launched ballistic missiles, land-based ICBMs, cruise missiles.
- 42) Which of the following are the correct phases of flight for an ICBM and are also in the correct order?
- A. Boost phase, Post-Boost phase, Midcourse phase, and Terminal phase
  - B. Boost phase, Strategic phase, Re-entry phase, and Engagement phase
  - C. Ascension phase, Midcourse phase, Boost phase, and Post-Boost phase
  - D. Boost phase, Engagement phase, Strategic phase, and Terminal phase
  - E. Ascension phase, Stellar phase, Midcourse phase, and Terminal phase

- 43) During the Cold War was there any physical barrier to prevent the crew of a U.S. submarine carrying nuclear-armed long-range ballistic missiles from launching them without Presidential authority?
- A. Yes
  - B. No
- 44) Which of the following is **not** an atmospheric phenomenon that could cause drag variations in a missile?
- A. Jet streams
  - B. Pressure fronts
  - C. Rayleigh Scattering
  - D. Surface winds
- 45) Which one of the following strategic nuclear delivery vehicles can be recalled after launch?
- A. Submarine-launched ballistic missiles
  - B. Land-based intercontinental ballistic missiles
  - C. Land-based intercontinental bombers
- 46) Which list of attributes correctly describes cruise missiles?
- A. Cruise missiles fly within the atmosphere at supersonic speeds.
  - B. Cruise missiles fly within the atmosphere at subsonic speeds.
  - C. Cruise missiles fly within and above the atmosphere at supersonic speeds.
  - D. Cruise missiles fly within and above the atmosphere at subsonic speeds.
- 47) Which of the following is **not** an attribute of ballistic missiles?
- A. Capability to have liquid or solid propellant.
  - B. Can be launched by fixed or mobile bases.
  - C. Can have single or multiple warhead payloads.
  - D. Can operate only endo-atmospherically.
- 48.) What is the range of an ICBM?
- A. 1,000 km to 3,000 km
  - B. 3,000 km to 5,500 km
  - C. 4,000 km to 8,000 km
  - D. 4,500 km to 6,500 km
  - E. 5,500 km to 12,000 km

**Questions 49-50 are related to an analysis recently published in the *Bulletin of the Atomic Scientists* which discusses the possibility of China developing MIRVs.**

49) The analysis discusses how China is considering using decoy warheads that are heavier than the common ones used by Russia and US in the past. Heavier decoy warheads make it harder to distinguish them from real warheads. Which of the following statements best describes why this is so?

- A.) Heavier decoy warheads will also be larger in size, making it harder for one to see the real warhead.
- B.) Since the RVs are deployed before re-entry, heavier decoy warheads will not experience as much drag as their light counterparts reentering the atmosphere, and thus they will follow the real warhead's trajectory more closely.
- C.) Since the decoy warheads are heavier, the RVs can be deployed after re-entry, giving one less time to determine which warhead is the real one.

50.) What is the most likely reason for the U.S. and Russia using lighter decoy warheads in the past?

- A.) Lighter decoys mean less material and thus are cheaper.
- B.) Making heavier decoys is a much more complicated process, and the technology to produce them has only recently been developed.
- C.) Lighter decoys can be made into complicated shapes, which can increase their ability to cloak the real warhead.
- D.) Heavier decoys would either significantly reduce the payload capacity of the ballistic missile or reduce the range of the missile.

### **E. Arsenals I**

51) About how many *total* nuclear weapons are there currently?

- A. 2,000
- B. 17,000
- C. 33,000
- D. 70,000

52) How many *total* nuclear weapons were there at their peak?

- A. 17,000
- B. 33,000
- C. 70,000
- D. 112,000

- 53) Which countries are believed to keep their nuclear warheads separately from military delivery systems?
- A. India and Pakistan
  - B. India, Pakistan and China
  - C. India, Pakistan, China and possibly Israel
- 54) About how many total warheads are there in the current American nuclear stockpile?
- A. 3,500
  - B. 7,700
  - C. 12,500
- 55) During the past two presidential administrations, U.S. spending on nuclear weapons and delivery systems has:
- A. stayed about the same
  - B. increased substantially
  - C. increased substantially
- 56) What best describes the nuclear arsenal of the United Kingdom?
- A. The U.K. maintains a full nuclear triad.
  - B. The U.K. only maintains submarine launched ballistic missiles.
  - C. The U.K. only maintains land-based ballistic missiles.
  - D. The U.K. has given up its nuclear arsenal.
- 57) About how many weapons does China have in its nuclear arsenal?
- A. 90
  - B. 240
  - C. 300
  - D. 2,400
- 58) Which statement best describes the strategy behind the Chinese nuclear program?
- A. China wishes to build a program on par with the programs of the United States and Russia.
  - B. China is de-emphasizing its nuclear program.
  - C. China is primarily concerned with internal threats.
  - D. China is mostly concerned with maintaining a second strike capability.

59) Which statement best describes the North Korean nuclear weapons program under Kim Jong-un? **[Multiple correct answers, mark all correct answers]**

- A. US and South Korea intelligence sources report that Kim Jong-un appears to de-emphasize the nuclear weapon program.
- B. Japanese intelligence sources report that North Korea de-emphasizes nuclear armament in favor of investments into naval forces.
- C. Chinese intelligence sources report that North Korea might seek to massively expand its number of nuclear warheads.
- D. US intelligence sources report that North Korea might be able to launch a nuclear armed ballistic missile.

60) Which countries use the Trident II D-5 in their nuclear arsenal? **[Multiple correct answers, mark all correct answers]**

- A. France.
- B. Israel.
- C. The United States.
- D. The United Kingdom.

**F.Arsenals – II**

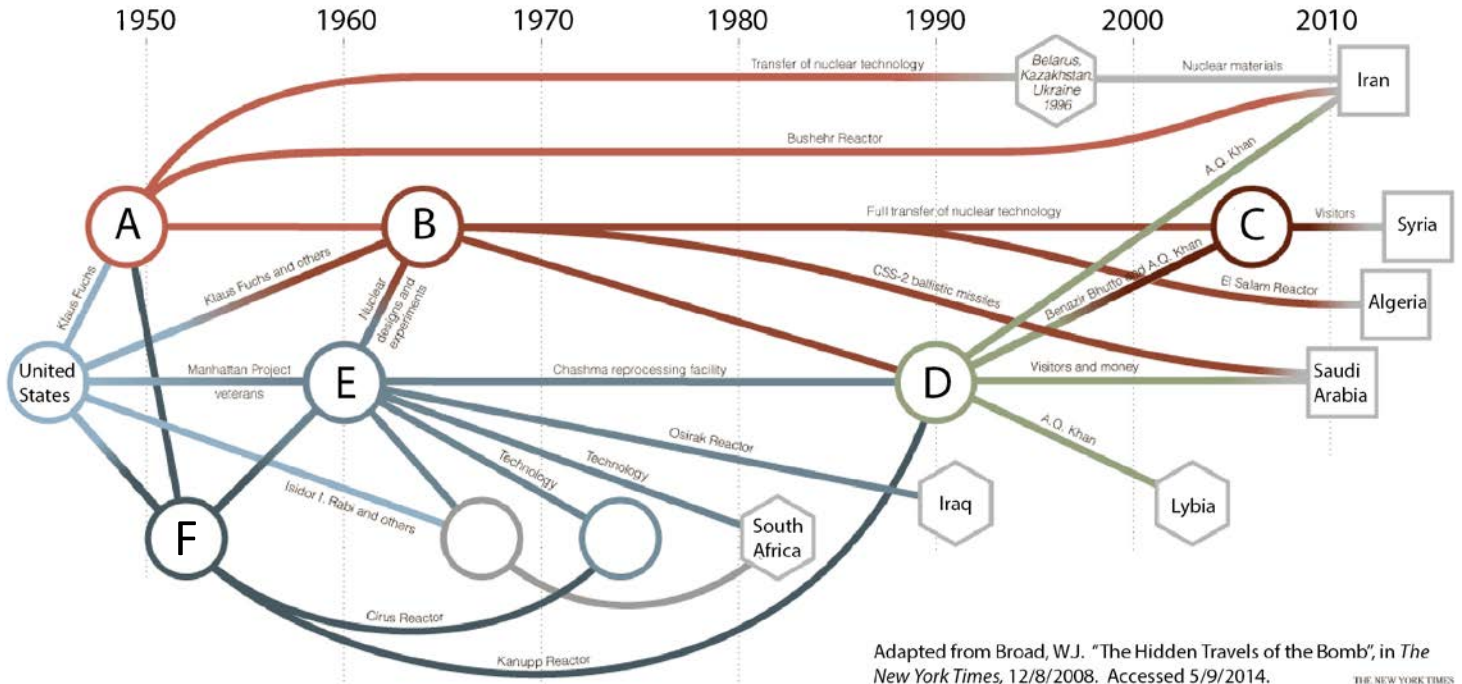
Use the graphic below and your knowledge to answer questions 61 and 62.

The place of each circle on the timeline represents the year of the country’s first nuclear test.

“Circles” represent states with known nuclear weapons capabilities.

“Squares” represent states thought to be developing nuclear weapons.

“Hexagons” represent states with abandoned nuclear weapons programs



61) Which country is represented by circle “F”?

- A. France
- B. China
- C. Russia/USSR
- D. United Kingdom

62) Which statement best describes the relationship between country “B” and “D”?

- A. Pakistan shared centrifuge technology with North Korea.
- B. Pakistan shared centrifuge technology with India.
- C. China shared missile technology with Iran.
- D. China helped India developing its nuclear program.
- E. China helped Pakistan developing its nuclear program.



- 63) Which countries currently deploy fully operational SLBMs
- A. Only the United States.
  - B. The United States, Russia and France.
  - C. The United States, Russia and China.
  - D. The United States, Russia the UK and France.
  - E. The United States, Russia and the UK.
- 64) About how many weapons does India have in its nuclear arsenal?
- A. 10
  - B. 240
  - C. 90
  - D. 300
- 65) What statement best describes the motivation behind Pakistan's 1998 nuclear test?
- A. It was a response to increased tensions with Iran.
  - B. It was a response to increased tensions with the US.
  - C. It was a response to increased tensions with China.
  - D. It was a response to increased tensions with India.
  - E. It was a joint test with Russia.
- 66) What fissile material is used in most of North Korea's nuclear weapons?
- A. Uranium
  - B. Plutonium
- 67) True or False: North Korea has shown visiting US representatives a centrifuge facility?
- A. True
  - B. False
- 68) North Korea tested a nuclear weapon in.... **[Mark all correct answers.]**
- A. 2003
  - B. 2005
  - C. 2006
  - D. 2009
  - E. 2012
- 69) Why does Iran say that it needs uranium enriched to 20% U-235?
- A. For civilian/energy uses.
  - B. To protect against the Israeli nuclear threat.
  - C. To develop a nuclear weapons program.
  - D. To export for civilian use to nations without natural Uranium resources.

70) Fill in the blank: All other things being equal, the effort required to go from natural Uranium to Uranium enriched to 20% U-235 is \_\_\_\_\_ the effort required to go from 20% U-235 to weapons grade Uranium.

- A. much less than                      B. about the same as                      C. much greater than

## H. Defense

71) Oscorp Industries has designed a scanner which can detect 100% of illegal radioactive and nuclear materials passing through the US ports. The scanner can be easily attached to the cranes which offload containers from ships. What is a potential problem with this system?

- A. The weapon can be detonated before being offloaded and still cause a large amount of damage.  
B. Terrorists can import non-radioactive materials and then use those to produce plutonium in the United States.  
C. Both A and B.

72) After decades of failure, the US government successfully builds and deploys two dozen ballistic missile interceptors, each capable of shooting down an incoming nuclear missile. A leaked Russian intelligence memo suggests that the Russians are not concerned about losing their nuclear deterrent, while North Korea begins preparing for a potential ground invasion. Why?

- A. Even with a missile defense system, the US would have trouble defending against Russian bombers, so the Russian deterrent would be preserved. The North Koreans have no such capability.  
B. The Russians have far more weapons deployed than the United States has interceptors and could overwhelm the system. The North Koreans have fewer missiles than the US has interceptors.  
C. A missile defense system could not disrupt the Russian *Kit*-class submarine nuclear weapons, which “swim” through the ocean before surfacing near the target.

73) What is **not** a non-technical reason why building a missile defense system could make the world less safe from nuclear attacks?

- A. The installation of an ABM system could trigger increases in offensive nuclear weapons systems.
- B. A missile defense system could be used to fire interceptor missiles at civilian targets in addition to shooting down incoming missiles.
- C. In fear of losing second-strike capability, a nuclear nation could use a strike first before a defense system is completed.

74) Missile defense during the terminal phase of a ballistic missile is difficult because:

- A. ballistic missiles “weave” up and down slightly because of the rotation of the Earth, making them more difficult to hit.
- B. countermeasures can only be used during the terminal phase.
- C. the missile is moving towards its final target at very high speeds.

75) Wayne Enterprises has developed a missile defense system which destroys enemy missiles during the boost phase. Which of the following is a potential description of the system?

- A. As the missile has engaged booster jets in the last phase of descent, a series of electromagnetic pulses disrupt the guidance system and disable the weapon.
- B. As the missile has left its silo and is moving towards the upper atmosphere, a laser targets and destroys the missile’s guidance system and it falls to Earth.
- C. While in space, an interceptor vehicle approaches the missile and engages an electromagnet, which causes the interceptor vehicle to stick to the missile, which then detonates prematurely.
- D. A helicopter positions itself between the missile and the target. After disabling the thrusters, the helicopter lifts the disabled bomb off the ground and flies it away from the target before it detonates.

76) What were the three “Nitze Criteria” an anti-ballistic missile defense system needed to fulfill before deployment? [**Mark all correct answers.**]

- A. The system must be effective.
- B. The system must be able to survive an attack
- C. The system must be cost effective at the margin
- D. The system must be stationed in a different country
- E. The system must be a mid-course intercept system

- 77) What is the “shortfall management problem” in regards to ballistic missile defense?
- A. Shortfall of resources from underfunding the federal Missile Defense Agency.
  - B. Impact ICBM failures under battle conditions have on the credibility of nuclear weapon defense.
  - C. Reentry vehicles traveling on altered trajectories after their rocket has been destroyed by a boost phase defense system.
- 78) Which of the following are passive defenses against nuclear attack? **[Mark all correct answers.]**
- A. Sheltering and crisis relocation.
  - B. Deter an attack rather than defeat it.
  - C. Prevent nuclear weapons from detonating at their target.
  - D. Laser based boost phase defense systems.
- 79) Which of the missile defense systems the US has tested or deployed were shown to be effective under battlefield conditions?
- A. None of them
  - B. Nixon’s safeguard system
  - C. Nixon’s safeguard and Bush’s Patriot systems
  - D. Bush’s Patriot system
- 80) Obama’s European Midcourse Intercept system will initially primarily rely on:
- A. Ground-based interceptor rockets
  - B. Ship-based lasers
  - C. Ship-based interceptor rockets
  - D. Airborne lasers
- 81) Which of the following are important challenges for a boost-phase intercept system? **[Mark all correct answers.]**
- A. ICBM boost phases are short.
  - B. Geographical constraints require high interceptor speeds.
  - C. ICBMs in powered flight accelerate unpredictably.
  - D. A successful intercept is unlikely to destroy the warhead.

- 82) During the 1991 Gulf war, the Patriot Missile Defense System was reported to be a great success. However, it was shown that the results were different than reported initially. In the end, how many intercepts of Iraqi short-range missiles were well documented?
- A. 0
  - B. 3
  - C. 5
  - D. 10
  - E. 15
- 83) Will ballistic missile defense defend against a nuclear terrorist attack on the United States?
- A. Yes, because terrorist's ballistic missiles are more rudimentary and therefore easier to intercept and destroy before impact.
  - B. No, because terrorists are more likely to use non-conventional means of delivering and detonating a nuclear weapon.
  - C. No, because ballistic missile defense is proven to be impractical and therefore the United States has abandoned all pursuit of a defense system.
- 84) Which missile defense system went into operation on October 1, 1975 but was terminated by the House the next day on October 2, 1975?
- A. Nixon's Safeguard Program
  - B. Reagan's Star Wars Program
  - C. Bush-I and Clinton's GPALs Program
  - D. Bush-II missile defense program
  - E. Obama's missile defense program
- 85) In which situation might an Iron Dome defense be useful? **[Mark all correct answers.]**
- A. Defend Seoul against an attack with rocket launchers from North Korea.
  - B. Defend Washington DC against an SLBM attack from a forward naval platform.
  - C. Defend Seoul against an attack with artillery from North Korea.
  - D. Defend Washington DC against a short range missile attack from a forward naval platform.
  - E. Defend against a single ICBM attack from North Korea on a US base in the Pacific.
- 86) Obama's proposed European midcourse missile defense system is aimed to defend a possible attack from
- A. Pakistan
  - B. Syria
  - C. Iran
  - D. Lybia

87) Obama's European-based midcourse defense system will initially rely primarily on

- A. Ground-based interceptor rockets
- B. Ship-based lasers
- C. Ship-based interceptor rockets
- D. Airborne lasers

88) Which of the following ranges describes best the federal funding level of the Missile Defense Agency in fiscal years 2010-2014?

- A. \$1-3 Billion / year
- B. \$5-8 Billion / year
- C. \$8-11 Billion/year
- D. \$13-16 Billion/year

89) On March 9<sup>th</sup> 2012, Israel was attacked with over 300 rockets from Gaza. It has been estimated that 177 rockets hit targets in Israel. The Iron Dome missile defense system engaged 71 rocket that were identified as potentially harmful. Reportedly, how many of the 71 rockets targeted were successfully intercepted?

- A. 56 or about 80%
- B. 36 or about 50%
- C. 7 or about 10%

90) What is the principal reason for the high success rate for the Iron Dome missile defense system compared to the PATRIOT system during the first Gulf War?

- A. Technological progress with battle control systems
- B. Technological progress with interceptor rockets
- C. The fact that Hamas SRBMs travel 500 m/s, less than a Mach 2 jet

### G. Arms Control

91) Why would the CTBT be beneficial to the United States?

- A. We already have the technology to model tests with computers, and don't need to perform live tests.
- B. It would hold back the nuclear programs of other states.
- C. It allows only the United States to test nuclear weapons.
- D. The CTBT will be based in New York, which will make the US the focus of discussions on nonproliferation.
- E. A and B

- 92) Which of the following is one method that the CTBT uses to detect nuclear tests?
- A. Infrasound
  - B. radionuclide detection
  - C. aerodynamic
  - D. all of the above
  - E. all except C
- 93) Where have nuclear explosions not been banned by an international treaty in force?
- A. The Ocean
  - B. The Moon
  - C. The Arctic
  - D. Underground
- 94) Why was the North Korean regime trying to hide their nuclear test in 2006?
- A. They were testing an illegal nuclear weapon and were afraid of the international response.
  - B. They didn't want the international community to know whether they tested a plutonium or uranium weapon.
  - C. They were concerned about the repercussions should the test fail.
- 95) Which of the following statements concerning the NPT is correct?
- A. It has the broadest scope of any arms control agreement.
  - B. It includes all of the nuclear weapons states.
  - C. It established the IAEA as the branch of the UN to enforce safeguard agreements.
  - D. All of the above.
- 96) At what point in treaty negotiations is a country obligated to obey the spirit of a treaty?
- A. Upon signature.
  - B. Upon ratification.
  - C. Upon approval by the UN General Assembly.
  - D. Upon agreeing to enter into negotiations.

97) What was the first treaty signed between the US and the USSR among the arms control treaties listed below?

- A. Limited Test Ban Treaty.
- B. Intermediate Nuclear Forces Treaty.
- C. Outer Space Treaty.
- D. Nuclear Nonproliferation Treaty.

98) What was the significance of the 1997 Additional Protocol to the NPT?

- A. It expanded the NPT to include new members.
- B. It reinforced export controls over dangerous dual use technology.
- C. It expanded the IAEA's power to perform inspections on civilian nuclear facilities.
- D. It removed North Korea from the NPT.

99) What major factor prevented an agreement between Reagan and Gorbachev at Reykjavik?

**[Mark all correct answers.]**

- A. Internal Russian politics.
- B. The US's refusal to give up ballistic missile defense.
- C. Russian refusal to reduce offensive nuclear weapons.
- D. Russian anger over the expansion of NATO.

100) Which of the following countries did give up nuclear weapons? **[Mark all correct answers.]**

- A. Belarus
- B. Ukraine
- C. South Africa
- D. Poland

101) What is the "supreme national interest clause" in regards to treaties?

- A. Treaties must be publicly available and not created in secret.
- B. The obligation to announce in advance when a country plans to withdraw from a treaty.
- C. Treaties are only valid when signed by democratically elected representatives.
- D. The duty of the most powerful countries to contribute the majority of resources for the implementation and enforcement of treaties.



- 102) Which most accurately depicts the scope of the International Atomic Energy Agency (IAEA)?
- A. Monitors 1,250 facilities in 135 countries.
  - B. Monitors 800 facilities in 100 countries.
  - C. Monitors 450 facilities in 65 countries.
  - D. Monitors 200 facilities in 40 countries.
- 103) What is the definition of vertical proliferation?
- A. More powerful nuclear weapons.
  - B. Increase in the number and/or capability of the nuclear weapons of states that already have them.
  - C. The sharing of nuclear weapons technology with developing countries
  - D. The existence of two clear leaders in the arms race, Russia and the U.S.
- 104) Which of the following are nuclear weapons states recognized by the NPT? [**Mark all that apply.**]
- A. United States
  - B. Russia
  - C. United Kingdom
  - D. France
  - E. China
- 105) Which of the following is not true of the 1992 Lisbon Protocol?
- A. Russia became the successor nuclear weapon state under NPT.
  - B. Russia, Belarus, Kazakhstan, Ukraine and US are signatories.
  - C. Half of Soviet weapons were given to Russia and the other half were eliminated.
  - D. Russia bound by START-I obligations.
  - E. Belarus, Kazakhstan and Ukraine to sign NPT as non-nuclear states.

- 106) What is the main goal of the IAEA safeguards system?
- A. To establish a “freeze” on existing levels of nuclear delivery systems.
  - B. To limit the number of MIRVed missiles and Heavy Bombers (HB) with cruise missiles.
  - C. To prohibit defenses against non-strategic ballistic missiles or cruise missiles.
  - D. To detect and deter diversion of nuclear materials used for civilian purposes to materials used to make weapons.
- 107) Which of the following goals is *not* included in the basic structure of the INF Treaty?
- A. Total global ban of a whole class of ground-based nuclear weapons.
  - B. Applies to delivery systems with a range between 500 and 5,500 km.
  - C. Fully remove the ABM systems of all nuclear weapons states.
  - D. Disarmament by destruction of in total 2,695 missiles.
  - E. Complete elimination of intermediate-range missiles (including cruise missiles).
- 108) What agreement does the New START treaty replace?
- A. START
  - B. SORT
  - C. CTBT
  - D. LTBT
- 109) How many sea based SM-3 interceptors would be deployed following President Obama’s initial plan for the European-based missile defense program by 2018?
- A. 200
  - B. 300
  - C. 400
  - D. more than 500
- 110) Which of the following is *not* a motivation for controlling nuclear weapons?
- A. It would reduce the threat of nuclear weapons being used in war or in terrorist attacks.
  - B. It decreases spending also for conventional defense systems.
  - C. It would enhance international security and stability.
  - D. It would facilitate international cooperation.

**E. Current Events**

111) Which of the following concerns was raised by Chinese government contacts on the North Korean Nuclear Weapons program?

- A. The DPRK has recently built a new missile capable of reaching the US.
- B. North Korea may have many more nuclear weapons than previously assumed.
- C. North Korea may be able to increase its nuclear weapons much faster than previously assumed.
- D. All of the above.
- E. B and C

112) Which of the following is **not** a demand of Israel regarding the Iranian nuclear deal?

- A. They recognize Israel as a state.
- B. They give up all enrichment capability.
- C. Removal of the entire stockpile of nuclear material from Iran's territory.
- D. They grant the Kurds autonomy.

113) What was Saudi Arabia's concern over the Iranian nuclear deal?

- A. It would endanger Israel.
- B. Iran is supporter of terrorism.
- C. It would result in an arms race in the Middle East.
- D. It would lead to the formation of a Kurdish state.

114) Which of the following countries is **not** part of the P5+1

- A. Britain
- B. China
- C. Japan
- D. Germany

115) How did Obama change US nuclear posture?

- A. He declared that deterrence was the only role for US nuclear weapons.
- B. He declared that the US would not use nuclear weapons first.
- C. He declared that deterrence was the fundamental role for US nuclear weapons.
- D. Both A and B

- 116) At the end of nuclear negotiations with Iran, what was the major disagreement between the two parties?
- A. The pace and scope of sanction relief.
  - B. The length of the break out time for Iran's centrifuge program.
  - C. The status of the Fordow nuclear site.
  - D. The type of missile Iran will be allowed to have.
- 117) Who will take Iran's excess stockpile of nuclear fuel as part of the agreement released in April?
- A. The US
  - B. Britain
  - C. Russia
  - D. France
- 118) Under the framework agreement Iran will **not** possess Uranium over \_\_\_\_ % U-235
- A. 5.5%
  - B. 3.0%
  - C. 2.1%
  - D. 3.7%
- 119) Which of the following is **not** part of the Iranian framework deal?
- A. Iran's "breakout time" to the bomb will be extended to one year.
  - B. All of Iran's nuclear facilities will be inspected by the IAEA.
  - C. Iran will reduce its number of centrifuges by 2/3.
  - D. Iran will forgo nuclear research and the underground facility at Fordow.
- 120) What was the main concern over the Iranian reactor at Arak?
- A. Production of Plutonium
  - B. Enrichment of Uranium
  - C. Nuclear Material Research
  - D. Ballistic Missile Development

**Check to make sure you bubbled in all your answers.  
Did you bubble in your name, exam version and network-ID?**