


1.	Which of the terms below refers to the energy absorbed by an organism due to radiation exposure:
a)	curie
b)	fission
c)	becquerel
d)	breeder reactor
e)	radiation absorbed dose
	Ans: e Difficulty: Easy Link to: A Closer Look 20.2

2.	Which of the terms below refers to the process in which a nuclear fuel, such as Uranium, is split into smaller particles plus energy:
a)	curie
b)	fission
c)	becquerel
d)	breeder reactor
e)	radiation absorbed dose
	Ans: b Difficulty: Easy Link to: 20.1

3.	Which of the terms below refers to a unit that signifies one radioactive decay per second:
a)	curie
b)	fission
c)	becquerel
d)	breeder reactor
e)	radiation absorbed dose
	Ans: c Difficulty: Easy Link to: A Closer Look 20.2

4.	Which of the following is an example of transuranic waste:
a)	plutonium
b)	carbon-14
c)	mercury
d)	cryptosporidium
e)	uranium-238

	<p>Ans: a</p> <p>Difficulty: Medium</p> <p>Link to: 20.3, A Closer Look 20.1</p>
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5.	<p>The sequence shown illustrates:</p>  <pre> graph LR A(mining) --> B(enrichment) B --> C(use) C --> D(reprocessing) D --> E(disposal) </pre>
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a)	a radioactive decay chain
b)	the nuclear fuel cycle
c)	the half-life of uranium
d)	beta decay
e)	passive stability

	<p>Ans: b</p> <p>Difficulty: Easy</p> <p>Link to: 20.2</p>
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6.	<p>The worst accident in the history of commercial nuclear power happened in 1986 at Chernobyl, where a uranium fuel meltdown occurred. According to the <u>Environmental Science</u> text, in the next 20 to 30 years, there will be an increase in cancer:</p>
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a)	worldwide
b)	in the northern hemisphere
c)	in northern Europe
d)	within 100-200 km of the reactor site
e)	in workers at the plant the day of the accident

	<p>Ans: c</p> <p>Difficulty: Medium</p> <p>Link to: 20.3</p>
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7.	<p>Which of the following is the most common fuel for nuclear fission?</p>
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a)	radium
b)	magnesium
c)	hydrogen
d)	sodium
e)	uranium

	<p>Ans: e Difficulty: Easy Link to: 20.1</p>
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8.	As a result of the Chernobyl accident, measurable amounts of radiation were detected:
a)	up to 30 km from the site
b)	up to 1000 km from the site
c)	over all of Europe and Asia
d)	over the Northern Hemisphere
e)	over the entire Earth
	<p>Ans: d Difficulty: Medium Link to: 20.3</p>

9.	No new commercial nuclear reactors have been built in the United States in a number of years. This is because:
a)	current technology is insufficient for sustained nuclear reactions
b)	the products of nuclear fusion can be used to make nuclear weapons
c)	at current energy prices, nuclear energy is not economical
d)	the supply of fuel-grade uranium is nearly exhausted
e)	political sentiment and uncertainty over reactor safety
	<p>Ans: e Difficulty: Medium Link to: 20.5</p>

10.	One concern in the U.S. regarding increased use of nuclear energy throughout the world, including in a broad range of developing countries is:
a)	lower prices for U.S. exports of electricity
b)	decreased reliance on fossil fuels
c)	increased greenhouse emissions
d)	loss of biodiversity
e)	proliferation of nuclear material that may end up in nuclear weapons
	<p>Ans: e Difficulty: Easy Link to: 20.5</p>

11.	Exactly how does a commercial nuclear power plant convert the energy of atomic nuclei into electricity?
a)	the heat produced by radioactive decay boils water, which drives a turbine generator
b)	thermoelectric cells in the core convert heat into electricity
c)	alpha decay emits electrons, which are collected by the control rods
d)	beta decay eliminates protons in the atomic nuclei, which creates a net negative charge
e)	spontaneous decay of radioisotopes creates a strong magnetic field, which induces a current in the electric dynamo
	Ans: a Difficulty: Medium Link to: 20.1

12.	At the present time, the method for handling high-level nuclear waste in the U.S. is:
a)	dilute and disperse
b)	temporary storage, pending completion of a permanent disposal site
c)	long-term disposal in salt mines
d)	export to France or Britain
e)	ocean-bottom disposal
	Ans: b Difficulty: Easy Link to: 20.3

13.	The half-life of carbon-14 is 5570 years. A woolly mammoth tusk was discovered, and laboratory analysis shows that it has one-eighth as much carbon-14 as modern organic material does. How old is the tusk?
a)	8,355 years
b)	11,140 years
c)	16,710 years
d)	44,560 years
e)	89,120 years
	Ans: c Difficulty: Medium Link to: A Closer Look 20.1

14.	All of the following are explanations of why nuclear energy has declined in the U.S. since the 1970s except :
a)	concerns over nuclear power plant safety
b)	decelerating electricity demand over the same interval
c)	growing concern over CO ₂ emissions and global warming
d)	spiraling costs of constructing nuclear power plants
e)	continued low costs of fossil fuels
	Ans: c Difficulty: Medium Link to: 20.5

15.	Hazardous radioactive materials produced by fission reactors include all of the following except :
a)	cesium-137
b)	krypton-85
c)	strontium-90
d)	plutonium-239
e)	helium-3
	Ans: e Difficulty: Medium Link to: 20.1

16.	If the U.S. is only 14th in the world in percentage of electrical energy generated by nuclear power, how can it be true that the U.S. produces almost twice as much total nuclear energy as its nearest competitor?
a)	nuclear power production outside the U.S. has been curtailed since the Chernobyl accident
b)	U.S. nuclear power plants are twice as efficient as any other country's plants
c)	U.S. nuclear power plants are more than twice as large as any other country's plants
d)	the U.S. has a much greater proportion of electricity in its total energy mix than do other countries
e)	the U.S. uses much more electricity than any other country
	Ans: e Difficulty: Easy Link to: 20.1

17.	Which of the following is the most common fuel for nuclear fusion?
a)	radium

b)	magnesium
c)	hydrogen
d)	sodium
e)	uranium
Ans: c Difficulty: Easy Link to: 20.1	

18.	The fuel for nuclear fission in commercial burner reactors is:
a)	radium
b)	uranium
c)	polonium
d)	hydrogen
e)	plutonium
Ans: b Difficulty: Easy Link to: 20.1	

19.	A radioactive isotope is a chemical element that undergoes:
a)	radioactive decay initiated by a catalyst
b)	spontaneous heat transmission
c)	spontaneous radioactive decay
d)	fusion under conditions of great temperature and pressure
e)	breakup into subatomic particles
Ans: c Difficulty: Easy Link to: A Closer Look 20.1	

20.	All of the following are problems or objections to building breeder nuclear reactors except :
a)	breeder reactors are more expensive to build
b)	breeder reactors are more expensive to run
c)	breeder reactors produce ingredients necessary for construction of nuclear weapons
d)	the breeder fuel, plutonium-239, will also eventually become depleted
e)	the current technology does not make commercial breeder plants economical

	<p>Ans: d Difficulty: Easy Link to: 20.2</p>
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21.	The energy retained by living tissue that has been exposed to radiation is called:
a)	radiation absorbed dose
b)	body burden
c)	Roentgens
d)	fallout
e)	bioluminescent energy
	<p>Ans: a Difficulty: Easy Link to: A Closer Look 20.2</p>

22.	Commercial nuclear reactors produce energy through the process of:
a)	incineration
b)	transmutation
c)	fusion
d)	breeding
e)	fission
	<p>Ans: e Difficulty: Easy Link to: 20.1</p>

23.	A gas-cooled reactor, known as pebble-bed reactor is being developed right now and may be available as early as 2006. What is special about this particular reactor?
a)	the reactor is able to breed its own fuel
b)	the core contains always just the right amount of fuel for optimal energy production
c)	the reactor uses water as a moderator
d)	the reactor uses hydrogen as fuel
e)	the reactor is able to breed its own fuel and the core contains always just the right amount of fuel for optimal energy production
	<p>Ans: b Difficulty: Medium Link to: 20.1</p>

24.	What role does water serve within the core of a commercial nuclear reactor?
a)	water is the fuel
b)	water speeds the nuclear reactions, making chain reactions possible
c)	water amplifies the nuclear radiations
d)	water "moderates" or slows down neutrons emitted by radioactive decay
e)	water reacts chemically with high-energy particles, rendering them inert
	Ans: d Difficulty: Easy Link to: 20.1

25.	Polonium-218 has a half-life of about 3 minutes. If 120 grams of the material is sealed into a lead container at exactly 5:00, how much of it will be found when the container is opened at 5:09?
a)	just over 13 g
b)	15 g
c)	40 g
d)	60 g
e)	120 g
	Ans: b Difficulty: Medium Link to: A Closer Look 20.1

26.	When radioactive uranium decays, it passes through a series of decay steps and ends up as:
a)	a stable radioactive isotope of uranium
b)	a stable non-radioactive isotope of lead
c)	hydrogen
d)	subatomic particles
e)	energy
	Ans: b Difficulty: Difficult Link to: A Closer Look 20.1

27.	Nuclear fission promises to be a virtually limitless supply of energy. However at present, it is not used to produce any electricity at all, because:
a)	environmental sentiment has put nuclear power into disfavor

b)	scarcity of appropriate fuel
c)	current technology is insufficient
d)	there are no safe sites to store the highly toxic waste produced by fission
e)	fusion is not a natural process; a sustained reaction may never be possible
	Ans: c Difficulty: Medium Link to: 20.1

28.	Since the 1990s nuclear power plants in the U.S. have added over 23,000 mW of power. This increase is the result of:
a)	adding new power plants to the existing ones in the U.S.
b)	the invention of the pebble-bed reactor
c)	using hydrogen as a fuel source
d)	more efficient use of existing power plants
e)	centralization of nuclear power
	Ans: d Difficulty: Medium Link to: 20.5

29.	In addition to spent fuel, waste material associated with nuclear energy includes:
a)	leachate
b)	slag
c)	medical waste
d)	uranium mine tailings
e)	heavy water
	Ans: d Difficulty: Easy Link to: 20.2

30.	The Energy Policy Act of 2005 considered the role of nuclear power in the U.S. energy mix. Its recommendation was to:
a)	resume building new nuclear power plants in the U.S.
b)	halt to construction of all new nuclear power plants in the U.S.
c)	temporarily hold construction of new nuclear power plants until the Yucca Mountain site is operational
d)	transition from fission to fusion power

e)	replace all existing nuclear reactors in the U.S. by pebble-bed reactors by 2010
	Ans: a Difficulty: Easy Link to: Case Study

31.	What is the role of the reactor within a nuclear power plant?
a)	it converts mass directly into electricity
b)	it releases high energy particles which turn turbines
c)	it provides heat
d)	it condenses steam into liquid water
e)	it breaks large radioisotopes into water, which turns turbines
	Ans: c Difficulty: Easy Link to: 20.1

32.	Isotopes are atoms of an element that:
a)	vary in atomic number
b)	have a higher number of protons and neutrons in the nucleus than other elements
c)	have a different number of electrons than other elements
d)	have the same atomic number but vary in the atomic mass number
e)	have a different number of neutrons in the nucleus
	Ans: d Difficulty: Easy Link to: A Closer Look 20.1

33.	Uranium-238 and Uranium-235 are two different:
a)	isotopes of uranium
b)	radioactive elements
c)	ions of the same element
d)	types of radioactive decay
e)	types of fuel for fusion reactors
	Ans: a Difficulty: Easy Link to: A Closer Look 20.1

34.	The joining of light atoms to form heavier nuclei is known as:
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a)	fission
b)	fusion
c)	isotopes
d)	radioactivity
e)	alchemy
	Ans: b Difficulty: Easy Link to: 20.1

35.	The series of different forms that a radioisotope takes during its lifetime is known as its:
a)	half-life
b)	radioactive decay
c)	chain reactions
d)	chain links
e)	decay chain
	Ans: e Difficulty: Easy Link to: A Closer Look 20.1

36.	Name the two best known commercial nuclear accidents. Of the two, circle the one that was more severe.
Ans:	Three Mile Island Chernobyl: much more severe – breach of containment vessel, 31 fatalities
	Difficulty: Easy Link to: 20.3

37.	Some of the transuranic waste material generated in the U.S. is being stored at the Waste Isolation Pilot Project (WIPP) near Carlsbad, NM in geological salt deposits. List at least two advantages of disposal of nuclear waste at this site or in salt in general.
Ans:	site is geologically stable salt is easily mined salt is impermeable and has little or no groundwater flow salt experiences ductile flow, sealing voids or fissures
	Difficulty: Medium Link to: 20.3

38.	What role does nuclear energy play in debates about acid rain and global warming?	
Ans:	Nuclear energy contributes little or nothing to either problem. It is an alternative to fossil fuels, which are direct contributors to both problems.	
	Difficulty: Easy Link to: 20.2	

39.	Name the important steps in the nuclear fuel cycle.	
Ans:	mining enrichment electrical generation reprocessing of spent fuel waste disposal decommissioning of worn-out reactors	
	Difficulty: Medium Link to: 20.2	

40.	The two major accidents to strike nuclear power facilities were the Three Mile Island and the Chernobyl accidents. Look at each of the following statements and determine whether the statement applies to Three Mile Island or Chernobyl.		
		<u>Circle the correct response</u>	
	Radiation exposure was in the vicinity of the power plant only.	3-Mile Island	Chernobyl
	There were at least 31 fatalities.	3-Mile Island	Chernobyl
	The reactor was graphite-moderated, and the fuel ignited and burned.	3-Mile Island	Chernobyl
	The accident occurred in 1979.	3-Mile Island	Chernobyl
Ans:	TMI, C, C, TMI		
	Difficulty: Medium Link to: 20.3		

41.	Nuclear energy has been called a “nonrenewable alternative energy source.” Is this a contradiction in terms?	
Ans:	It is nonrenewable because it requires uranium as a fuel. It is a geologic resource that took millions of years to form deposits of sufficient concentration. However, it is an alternative to fossil fuels.	
	Difficulty: Medium Link to: 20.1	

42.	One of the main public concerns about nuclear energy is the potential for exposure to radiation. List three or more <u>natural</u> sources of radiation in the environment.	
Ans:	the Sun uranium in rocks (granite is a rock rich in uranium) radioisotopes in the atmosphere, like radon and carbon-14	
	Difficulty: Easy Link to: 20.2	

43.	What is meant by 'half life' of a radioactive atom?	
Ans:	The half life of a radioactive atom is the time required for one-half of a given amount of the isotopes to decay to a subsequent form.	
	Difficulty: Easy Link to: A Closer Look 20.1	

44.	Why are small reactors with a cooling system that works under influence of gravity thought to be much safer than big reactors with a pump cooling system?	
Ans:	Reactors with a cooling system that works under gravity influence do not rely on technology which might fail during electric power loss or accidental shut-offs. .	
	Difficulty: Medium Link to: 20.1	

45.	Explain how a pebble-bed reactor functions.	
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Ans:	a pebble-bed reactor is analog to a gum ball machine. Fuel pebbles are fed into the core of the reactor continuously refueling the nuclear reaction. With this safety feature the core has just the right amount of fuel at any given time.
	Difficulty: Medium Link to: 20.1

46.	Why is the natural background dose of radiation variable in different locations?
Ans:	The natural background radiation depends on the bedrock geology and the elevation.
	Difficulty: Medium Link to: A Closer Look 20.2

47.	What are the problems with or objections to building breeder nuclear reactors?
Ans:	more expensive to build than burner reactors more expensive to run produce ingredients necessary to construction of nuclear weapons
	Difficulty: Medium Link to: 20.1, 20.2

48.	At the present time, how is high-level nuclear waste being disposed of in the United States?
Ans:	At the present time, most of it is not disposed. It is being stored, pending completion of a safe, permanent disposal site.
	Difficulty: Easy Link to: 20.3

49.	What are the two ways that radioisotopes threaten the environment?
Ans:	by emitting radiation directly by entering the normal pathways of mineral cycling and the ecological food chain

	Difficulty: Medium Link to: 20.2
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50.	What happens during a core meltdown in a radioactive power plant?
Ans:	A core meltdown is a nuclear accident in which the nuclear fuel becomes so hot that it forms a molten mass that breaches the containment of the reactor and contaminates the surrounding environment.
	Difficulty: Easy Link to: 20.1

51.	What are the two nuclear processes that can be used to release energy? Define each one.
Ans:	fission - splitting atoms into smaller fragments fusion - combining atomic nuclei into larger nuclei
	Difficulty: Easy Link to: 20.1

52.	Describe briefly the difference between high-level nuclear waste and low-level nuclear waste
Ans:	high-level nuclear waste: spent fuel elements from commercial reactors low-level nuclear waste: any slightly contaminated material
	Difficulty: Medium Link to: 20.3