1.	Which of the following terms refers to energy that is stored; for example the gravitational energy of water behind a dam:
a)	potential energy
b)	kinetic energy
c)	cogeneration
d)	soft path energy
e)	first-law efficiency
	Ans: a Difficulty: Easy Link to: 17.1

2.	Which of the following terms refers to the capture and use of waste heat:
a)	potential energy
b)	kinetic energy
c)	cogeneration
d)	soft path energy
e)	first-law efficiency
	Ans: c Difficulty: Easy Link to: 17.5

3.	The ratio of the actual amount of energy delivered where it is needed to the amount of energy supplied in order to meet that need:
a)	potential energy
b)	kinetic energy
c)	cogeneration
d)	soft path energy
e)	first-law efficiency
	Ans: e Difficulty: Medium Link to: 17.5

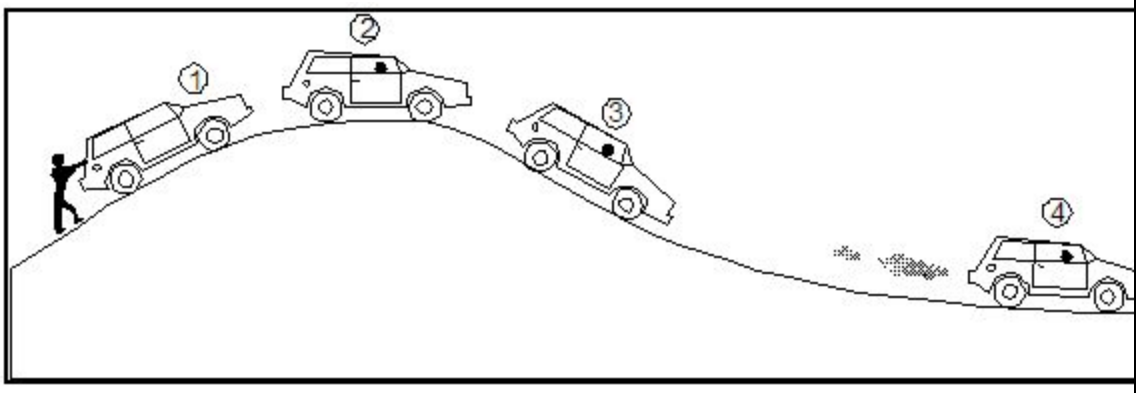
4.	Which of the following are the three main energy sources used in the U.S?
a)	petroleum, coal, and nuclear
b)	wood, petroleum, and nuclear
c)	hydroelectric, natural gas, and coal
d)	coal, gasoline, and nuclear

e)	petroleum, natural gas, and coal
	Ans: e Difficulty: Easy Link to: 17.4

5.	Total worldwide energy use today is about 13.8 terawatts (trillions watts), and that figure is increasing very rapidly. The two general trends that are leading to the rapid increase in energy use are population growth and:
a)	increasing urbanization
b)	declining energy efficiency
c)	changes from fossil fuels to alternative energy sources
d)	rising standard of living
e)	increasing demands for environmentally benign energy
	Ans: d Difficulty: Easy Link to: 17.1

6.	A train carries 200 passengers from Washington, D.C. to New York. The locomotive uses 2800 liters of diesel fuel during the trip. Afterwards, all the energy that was in the diesel changed to:
a)	potential energy
b)	kinetic energy
c)	heat
d)	high-quality energy
e)	antimatter
	Ans: c Difficulty: Easy Link to: 17.2

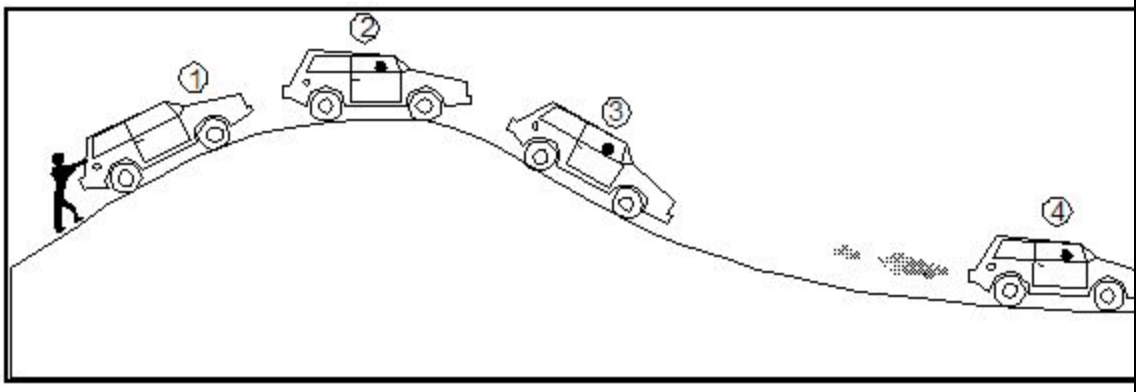
7. The car has the greatest potential energy:



a) at position 1
b) at position 2
c) at position 3
d) at position 4
e) just after a fill-up

Ans: b
Difficulty: Easy
Link to: 17.2

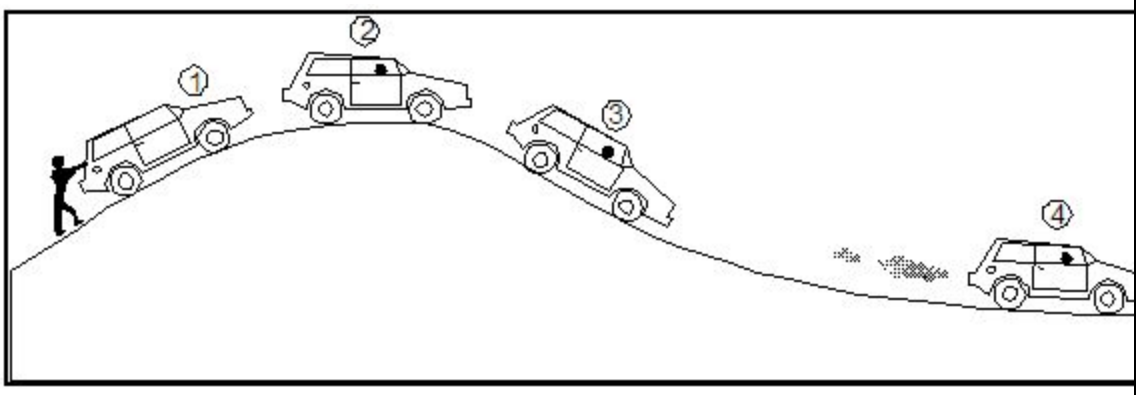
8. The car in the figure below has the greatest kinetic energy at:



a) position 1
b) position 2
c) position 3
d) position 4
e) the position at which the car is moving the fastest

Ans: e
Difficulty: Easy
Link to: 17.2

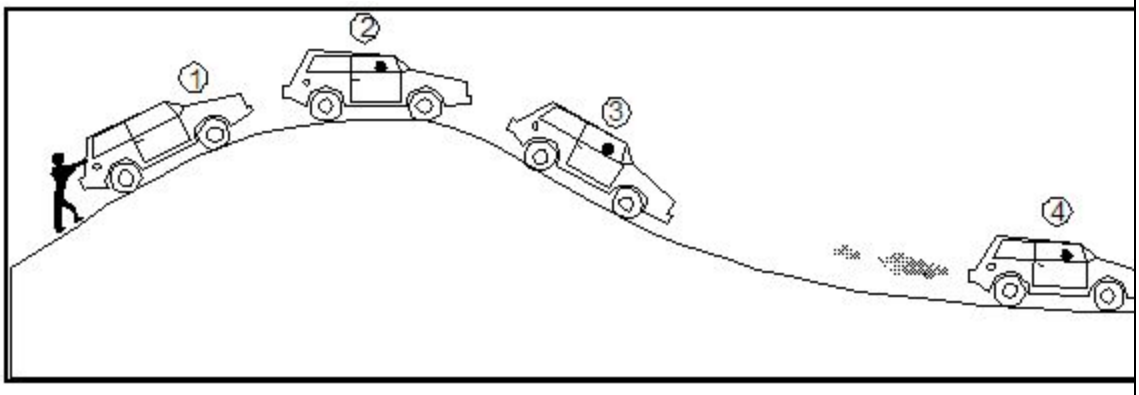
9. At position 4 in the figure below, the car is accelerating. The energy that causes that acceleration is coming from:



a) potential energy
b) kinetic energy
c) chemical potential energy
d) momentum
e) heat

Ans: c
Difficulty: Easy
Link to: 17.2

10. At position 5 in the figure below, which is 100 meters down the road from position 4, there is a stop sign. When the car has stopped, all of the energy that went into moving the car goes into:



a) potential energy
b) kinetic energy
c) chemical potential energy
d) momentum
e) heat

	Ans: e Difficulty: Easy Link to: 17.5

11.	The majority of Earth's energy input comes from:
a)	geothermal heat from the Earth's interior
b)	the Earth's albedo
c)	sunlight
d)	combustion of fossil fuels
e)	photolysis of ozone in the stratosphere
	Ans: c Difficulty: Easy Link to: 17.1

12.	_____ is an example of a fossil fuel; _____ is an example of an alternative energy source; and _____ is an example of a renewable energy source:
a)	coal; nuclear; solar
b)	nuclear; solar; natural gas
c)	nuclear; natural gas; hydroelectric
d)	petroleum; solar; coal
e)	hydroelectric; wind; solar
	Ans: a Difficulty: Medium Link to: 17.4

13.	Which energy source supplies the majority of electrical power generation in the U.S.?
a)	hydroelectric
b)	solar
c)	nuclear
d)	coal
e)	oil
	Ans: d Difficulty: Easy Link to: 17.5

14.	Energy:
a)	is the product of force times distance

b)	can be destroyed
c)	is always conserved
d)	cannot be transformed
e)	cannot be conserved

Ans: c
Difficulty: Easy
Link to: 17.1

15.	The first law of thermodynamics states that:
a)	efficiency of energy conversion is always less than 100%
b)	energy is never created, never destroyed, but always preserved
c)	the present is the key to the past
d)	energy is measured in joules, power in watts
e)	energy can go from higher quality forms to lower, but not in the opposite direction

Ans: b
Difficulty: Medium
Link to: 17.2

16.	The second law of thermodynamics states that:
a)	efficiency of energy conversion is always less than 100%
b)	energy is never created, never destroyed, but always preserved
c)	the present is the key to the past
d)	energy is measured in joules, power in watts
e)	energy can go from higher quality forms to lower, but not in the opposite direction

Ans: e
Difficulty: Medium
Link to: 17.2

17.	"Soft path" energy strategies feature all of the following characteristics **except**:
a)	sustainable energy sources
b)	integrating high-tech solutions to improve sustainability and efficiency
c)	addition of large-scale nuclear fusion to our energy mix
d)	diverse energy sources appropriate to end-use needs
e)	energy supply appropriate to local sources and people

	Ans: c Difficulty: Medium Link to: 17.6

18.	Hard path energy is characterized as:
a)	high quality, decentralized, low technology
b)	high yield, technology-intensive, and flexible
c)	centralized, technology-intensive, and high yield
d)	high tech, polluting, and based entirely on fossil fuels
e)	centralized, diverse, low yield
	Ans: e Difficulty: Medium Link to: 17.6

19.	As an example of first-law efficiency, a gasoline powered car might have an efficiency of 65%, but an electric car might have an efficiency of 35% from the original fossil fuel (coal burned to make electricity) to the end use. This is because:
a)	burning large volumes of coal in an electric utility is less efficient than utilizing small quantities of gasoline
b)	electricity is a lower quality energy source than gasoline
c)	every step in converting energy to a different form is less than 100% efficient, and the electric car has an extra step
d)	energy always goes from a higher quality form to a lower
e)	electric car technology is not as far advanced as gasoline technology
	Ans: c Difficulty: Medium Link to: 17.3

20.	Soft path energy is characterized as:
a)	low technology, decentralized, with zero effect on the environment
b)	high quality, high technology, based on renewable sources
c)	focused on conservation, centralized, and high technology
d)	diverse, low quality energy, based on renewable sources
e)	centralized, based on applying high-tech solutions to improve efficiency and yield

	Ans: d Difficulty: Medium Link to: 17.6

21.	Soft path energy has all of the following characteristics **except**:
a)	diverse and flexible
b)	local and decentralized
c)	focused on renewable sources
d)	close match between energy quality and end-use
e)	environmental effects shifted from the local level to the regional
	Ans: e Difficulty: Easy Link to: 17.6

22.	"Cogeneration" refers to the use of:
a)	waste heat to improve overall efficiency
b)	scrubbers to reduce sulfur emissions
c)	steam turbines to produce electricity
d)	alternative energy sources
e)	pump-storage facilities
	Ans: a Difficulty: Easy Link to: A Closer Look 17.2

23.	Refer to the Case Study in the textbook: "National energy policy." What was the basic reason that California faced a serious energy crisis in 2001?
a)	California lawmakers refused to support hard path energy policies
b)	several utility companies operating in the state went bankrupt
c)	not enough oil and coal was available
d)	energy demand rose because economic growth brought more people to the state
e)	all of these
	Ans: d Difficulty: Medium Link to: Case Study

24.	*The two countries of Botkinlandia and Kellertopia share one single power plant with a maximum capacity of 10 gigawatts (10 billion watts = 10,000,000 kW). Kellertopia is small and prosperous, with a stable population of 500,000 and average energy use of 8 kW per capita. Botkinlandia is larger (pop.=1,000,000), less developed (per capita energy use = 1 kW), and growing fast (population and per capita energy use doubling every 20 years).* Today, Kellertopia uses 80% of the electricity generated. What percent will it use in 40 years?
a)	20%
b)	25%
c)	33%
d)	50%
e)	67%
	Ans: b Difficulty: Difficult Link to: A Closer Look 17.1

25.	*The two countries of Botkinlandia and Kellertopia share one single power plant with a maximum capacity of 10 gigawatts (10 billion watts = 10,000,000 kW). Kellertopia is small and prosperous, with a stable population of 500,000 and average energy use of 8 kW per capita. Botkinlandia is larger (pop.=1,000,000), less developed (per capita energy use = 1 kW), and growing fast (population and per capita energy use doubling every 20 years).* For how long will the existing power plant be able to supply all of the demand for electricity of the two countries?
a)	the power plant is at its limit right now
b)	the capacity will be exceeded in less than 5 years
c)	the capacity will be exceeded in less than 10 years
d)	the capacity will be exceeded in 20 years
e)	capacity will never be exceeded
	Ans: c Difficulty: Difficult Link to: A Closer Look 17.1

26.	Which energy transformation occurs as a book falls from the top of your book shelf towards the floor?
a)	the book's potential energy and kinetic energy decreases
b)	the book's potential energy decreases and it's kinetic energy increases

c)	the book's potential energy increases and it's kinetic energy decreases
d)	the book's potential energy and kinetic energy increase
e)	according to the first law of thermodynamics, both energies stay the same

Ans: b
Difficulty: Easy
Link to: 17.2

27. _____ are units of energy, and _____ are units of power:

	I. Exajoules; kilowatt-hours
	II. Joules; watts
	III. BTUs; kilowatts

a)	I only
b)	II only
c)	III only
d)	II and III
e)	I, II, and III

Ans: d
Difficulty: Medium
Link to: A Closer Look 17.1

28. The principal of the conservation of energy is known as:

a)	potential energy
b)	kinetic energy
c)	the first law of thermodynamics
d)	thermometry
e)	the second law of efficiency

Ans: c
Difficulty: Easy
Link to: 17.3

29. The biosphere continuously receives _____ from the Sun and radiates _____ into space.

a)	high-grade heat, low-grade energy
b)	low-grade energy, low-grade heat
c)	high-grade heat, no energy
d)	low-grade energy, high-grade heat
e)	high-grade energy, low-grade energy

Ans: e
Difficulty: Easy
Link to: 17.2

30. Water stored behind a dam is an example of:

a) potential energy
b) kinetic energy
c) efficient energy
d) inertial energy
e) momentum

Ans: a
Difficulty: Easy
Link to: 17.2

31. Which of the following is the lowest quality energy form:

a) sunlight
b) electricity
c) water
d) heat
e) biomass

Ans: d
Difficulty: Easy
Link to: 17.2

32. Which of the following describes the term "cogeneration" best:

a) generation of heat energy in a cycle
b) using alternative and traditional power supplies together
c) a more efficient production of heat energy
d) the capture and use of waste heat
e) none of these

Ans: d
Difficulty: Medium
Link to: 17.5

33. For each of the units below, state whether the unit measures:

A) power
B) energy
C) the unit electricity commonly is sold in

Joule _____

	British Thermal Unit	_____
	Watt	_____
	Quad	_____
	Kilowatt-hour	_____
	Exajoule	_____
Ans:	B, B, A, B, C, B	
	Difficulty: Easy Link to: A Closer Look 17.1	

34.	In ancient Rome, a law was established to protect a person's right to unobstructed sunlight. On what need was this law based on? Under what conditions might this law make sense today?	
Ans:	This law was based on energy scarcity. Wood supplies were insufficient to heat homes in winter, and they had to rely on passive solar energy.	
	Difficulty: Medium Link to: 17.1	

35.	The textbook lists three general areas that should be targeted for greater energy efficiency. List these three areas and, for each, name one way in which efficiency could be improved.	
Ans:	**building design –** integral urban houses (also, increased insulation) **industrial energy –** use of cogeneration **automobile design –** increased fuel efficiency (for example, by replacing steel parts with lighter aluminum)	
	Difficulty: Medium Link to: 17.5	

36.	The textbook lists (1) building design, (2) industrial energy, and (3) automobile design as general areas that should be targeted for greater energy efficiency. For each of these areas, name one way in which efficiency could be improved.

	building design:
	industrial energy:
	automobile design:

Ans:	**building design –** integral urban houses (also, increased insulation) **industrial energy –** use of cogeneration **automobile design –** increased fuel efficiency (for example, by replacing steel parts with lighter aluminum)
	Difficulty: Medium Link to: 17.5

37.	Name three renewable energy resources.
Ans:	water (hydropower) wood hydrothermal energy solar energy
	Difficulty: Easy Link to: 17.6

38.	According to the Environmental Science text, which areas of our socio-industrial complex should be targeted for the development of more energy efficiency? List three.
Ans:	building design industrial energy automobile design
	Difficulty: Easy Link to: 17.5

39.	Characterize **nuclear energy** in each of the following ways (Circle the correct answer for each):	
	a fossil fuel:	(**yes** or **no**)
	a renewable resource:	(**yes** or **no**)
	an "alternative" energy supply	(**yes** or **no**)
	a _____ path energy source	(**soft** or **hard**)
Ans:	no, no, yes, hard	

	Difficulty: Easy Link to: 17.6

40.	Producing one unit of electrical energy from coal or oil requires three units of energy input (coal, oil). What happens to the rest?	
Ans:	becomes heat	
	Difficulty: Easy Link to: 17.4	

41.	The following concepts are relevant to the Earth's energy balance. Define each: (a) Albedo: (b) Electromagnetic Spectrum: (c) Earthshine: (d) Negative Feedback:	
Ans:	a. albedo – reflectivity of the planetary surface b. electromagnetic spectrum – the full range of wavelengths of the electromagnetic spectrum c. earthshine – heat energy radiated from the Earth to space d. negative feedback – a mechanism by which an initial stimulus tends to damp itself out – a mechanism that tends to stabilize a system	
	Difficulty: Medium Link to: Chap. 17	

42.	Fundamental characteristics of energy are reflected in the first and second laws of thermodynamics (energy laws). Define these two laws.	
Ans:	conservation of energy, entropy	
	Difficulty: Easy Link to: 17.3	

43.	Energy for most of the mechanisms of human society comes from heat engines of different types. Name three broad classes of environmental effects of heat engines.

Ans:	acid rain thermal pollution urban smog potential global climate change
	Difficulty: Medium Link to: 17.3

44.	Give an example of cogeneration.
Ans:	An example of cogeneration is a natural gas combined power plant that produces electricity in two ways: gas cycle and steam cycle. In the gas cycle gas is burned to produce electricity, while in the steam cycle, hot exhaust from the gas turbine is used to create steam which in turn is able to produce electricity.
	Difficulty: Medium Link to: 17.5

45.	In ancient Rome and Greece energy problems were already well known. What was the solution discussed in the Environmental Science text?
Ans:	passive solar energy
	Difficulty: Easy Link to: 17.1

46.	Can a heat engine convert all of the energy input into work? Why or why not?
Ans:	No – no heat engine is 100% efficient.
	Difficulty: Medium Link to: 17.2

47.	List the three major fossil fuels we are presently dependent on in order of their proportion of U.S. supply:
Ans:	1) coal 2) oil 3) gas

	Difficulty: Easy Link to: 17.4

48.	Name two reasons for the use of hard path energy and two reasons for the use of soft path energy.
Ans:	hard path: - long history of success - it has produced the highest standard of living soft path: - renewable - environmentally benign
	Difficulty: Medium Link to: 17.6

49.	*The two countries of Botkinlandia and Kellertopia share one single power plant with a maximum capacity of 10 gigawatts (10 billion watts = 10,000,000 kW). Kellertopia is small and prosperous, with a stable population of 500,000 and average energy use of 8 kW per capita. Botkin-landia is larger (pop.=1,000,000), less developed (per capita energy use = 1 kW), and growing fast (population and per capita energy use doubling every 20 years).* Instead of building additional power plants, propose population and energy-use goals for both countries that will allow them to manage with the electricity they have.
Ans:	e.g., Botkinlandia: pop. stabilized at 2,000,000; energy use = 3.5 kW Kellertopia: pop. = 500,000; energy use = 6.0 kW
	Difficulty: Medium Link to: A Closer Look 17.1