

SAMPLE MULTIPLE CHOICE QUESTIONS

(Organized by chapter—answers follow)

Chapter 1: Introduction

1. Which of the following statements are true (only one):
 - a. The growth rate of energy consumption has kept pace with GNP growth.
 - b. Oil use has expanded more than any other fuel since 1940.
 - c. We reached the point last year where we imported no oil.
 - d. Electricity use has actually fallen since 1975.

2. Which of the following is a non—renewable resource?
 - a. uranium b. water c. wind
 - d. biomass e. radiant solar

3. Today, the U.S. imports about what percentage of the oil it uses?
 - a. 10% b. 25% c. 45%
 - d. 65% e. 80%

4. One of the primary motivating forces behind our per capita reduction in energy use in the 1980's was _____.
 - a. a smaller population growth
 - b. higher oil prices
 - c. increased nuclear power costs
 - d. increased domestic oil discoveries

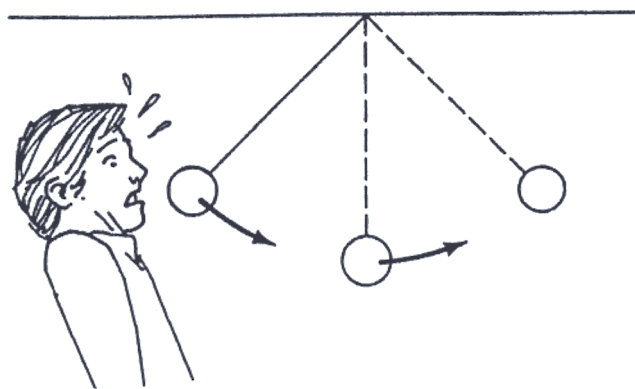
5. The most significant aspect of world consumption of energy over the last 40 years has been the _____.
 - a. growth of nuclear power
 - b. expanding use of oil
 - c. increased use of coal
 - d. emphasis on energy conservation
 - e. increase in our fossil fuel reserves

6. If you started with \$100 in the bank and you had \$200 after letting it sit there for 5 years, what would be the annual interest rate you received?
- a. 2% b. 5% c. 10%
d. 14% e. 22%
7. Continued use of the fuels most relied upon in developing countries will eventually lead to _____.
- a. depletion of soil nutrients
b. severe thermal pollution of water
c. increased oil prices
d. depletion of coal reserves in those countries
8. If the growth rate of the number of solar collectors is 7% per year, then 1000 units in use in 1980 will grow to _____ units by the year 2010.
- a. 1200 b. 2000 c. 4000
d. 8000 e. 20,000
9. The Hubbert curve for an energy resource displays what quantity on the y-axis?
- a. time b. total production c. yearly production
d. amount of fuel left

Chapters 2 and 3: Energy Mechanics:

10. A net force of 30 newtons is applied to a block of mass 10 kg. The force that must be applied to a block of mass 5 kg to give it equal acceleration is _____.
- a. 5 b. 10 c. 15
d. 20 e. 30 N
11. If a constant non—zero force is applied to an object, its velocity will _____.
- a. increase b. decrease c. be zero
d. be constant e. equal acceleration
- Which of the following is a unit of energy:
- a. watt b. ft—lb/sec c. newton/sec.
d. horsepower e. joule

- Our nosecracker moved back and forth as shown. The kinetic energy will be greatest at point:



- a. A b. B c. C

- For a fossil fueled electrical generating plant, 10,000 Btu of chemical energy into the plant will result in about how many Btu's of waste heat dumped into the environment:

- a. 0 b. 1000 c. 4000
d. 6000 e. 10,000 Btu's

15. If a net force of 30 newtons is applied to a cart of mass 3 kg at rest, the velocity of the cart at the end of 5 meters will be

- a. 5 b. 10 c. 12
d. 25 e. 30 m/sec

- The cost of running a series of 8 100 watt light bulbs for 6 hours, with the cost of electricity at 9¢ per kWh, is approximately:

- a. 5¢ b. 24¢ c. 43¢
d. 54¢ e. 72¢

17. A 100 lb sack of potatoes falls from an airplane. As the velocity of fall increases, the air resistance also increases. When air resistance equals 100 lb, the acceleration of the sack will be _____ m/sec/sec.

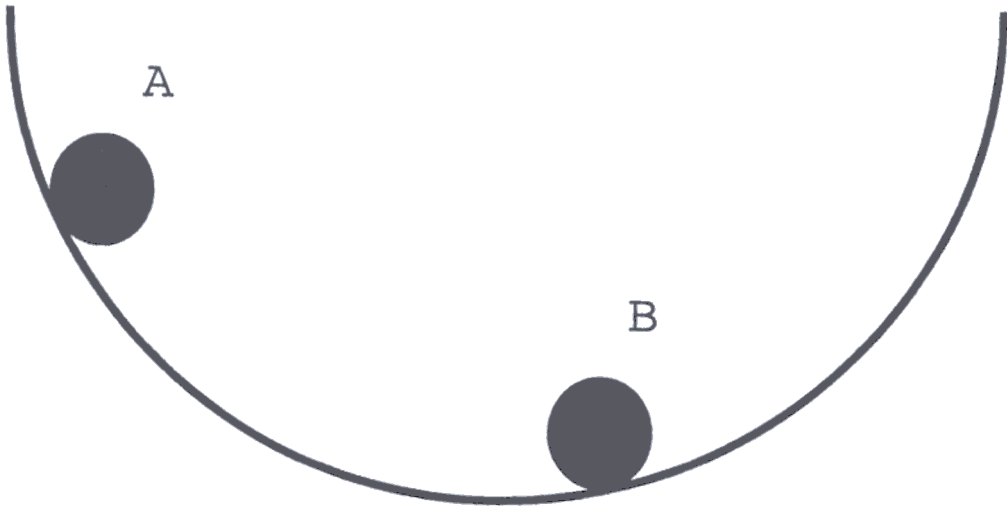
- a. 0 b. 16
c. 32 d. 9.8

18. Pumped storage facilities _____.
- increase the overall efficiency of a power plant
 - make use of the output of electricity from photovoltaic cells
 - are used to produce output mainly at night
 - have an increase in their potential energy mainly at night
 - cannot be used with a nuclear plant
19. If the energy conversion efficiencies in a 3 step process are 30% for the first step, 40% for the second, and 20% for the third, the overall efficiency (step one to end) is about:
- 2%
 - 10%
 - 20%
 - 50%
 - 90%
20. What is the minimum work that a motor must do to lift a 70 lb object from the floor to a height of 14 feet?
- 5
 - 70
 - 700
 - 980
 - 2010 ft-lbs
21. If the push that you give to a bike is the action force, then the reaction force is _____.
- the force of the bike upon you
 - the weight of the bike
 - the friction force on the tires
 - the acceleration of the bike
22. If the height of water behind a dam is increased by a factor of two, then the maximum kinetic energy of the water at the bottom of the dam will increase by a factor of _____.
- one
 - two
 - four
 - zero
23. The net force required to move a body at a constant velocity in outer space is _____.
- zero
 - its weight
 - the force of gravity
 - its mass times its velocity
 - the force of friction

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24. If you shout across a canyon and the echo returns in four seconds, how far away is the other side? (Velocity of sound is 300 in/s).
- a. 150
 - b. 300
 - c. 600
 - d. 1200 meters
25. Power is defined as _____.
- a. the energy used times the time
 - b. the work done times the distance of motion
 - c. the energy used divided by the work
 - d. the rate of converting energy
 - e. the ability to do work
26. If a 60 kg person is observed to accelerate at a rate of 4 m/sec/sec, the net force responsible for this is:
- a. 600 N
 - b. 240 N
 - c. 30 N
 - d. the force of gravity
 - e. 480 N
27. The "efficiency" of a light bulb is the ratio of the:
- a. heat plus electricity produced to the electrical input
 - b. voltage output of the bulb to the power input
 - c. energy into the bulb to the energy out of the bulb
 - d. light output to the electrical energy input

29. A ball rolls back and forth on the track shown. The kinetic energy at position A will be _____ than that at position B.
- greater
 - smaller
 - the same as



30. The reason that you would use a ramp to carry a weight to the top of a platform, rather than lifting it up a ladder, is because the
- force exerted would be less
 - work done would be less
 - power expended would be less
 - gain in potential energy would be more
30. How much work is required to increase the velocity of a 4 kg car from rest to 5 in/sec?
- 10
 - 20
 - 50
 - 100
 - 200 Joules
31. If the same force is applied to a 2 kg object as to a 1 kg one, _____.
- the velocity of the 2 kg object will be greater after 2 sec.
 - the distance traveled in the same time will be more for the 1 kg object
 - the acceleration of the larger object will be more
 - the acceleration of the 1 kg object will be 4 times more

- A sheet of paper can be withdrawn from under a bottle of milk without toppling the bottle if the paper is jerked out quickly. This is an example of _____
- inertia
 - action-reaction
 - potential energy
 - friction forces
33. Which of the following is a unit of power?
- Btu
 - kilowatt
 - kilowatt-hour
 - joule
 - horsepower per hour

Chapters 4 and 5: Heat:

- Heat is _____.
- a measure of the average kinetic energy of molecules in an object
 - a property of an object
 - the energy transferred between bodies due to a temperature difference
 - the specific heat of an object
35. Heat energy will spontaneously always flow in the direction of _____.
- a higher temperature
 - a lower temperature
 - up, since heat rises
 - a smaller heat capacity
- What color would you select for a container that will hold ice cubes such that the ice is preserved the longest?
- | | |
|----------|-------------------------|
| a. white | b. black |
| c. green | d. color doesn't matter |

- At a restaurant you are served coffee before you are ready to drink it. In order that the coffee be the hottest when you are ready for it, when would it be best to add cream (at room temperature) to it?
- when you are ready to drink it
 - right when you are served the coffee
 - it doesn't matter, as the final temperature will be the same
38. An efficient wood-burning stove has an advantage over an open fireplace primarily because
- combustion air intake is limited
 - higher temperatures are reached
 - creosote buildup is reduced
 - most heat transfer occurs by radiation

If the R-value of a wall is $10 \text{ ft}^2 \cdot ^\circ\text{F} \cdot \text{hr}/\text{Btu}$, then the rate of heat transfer through a $2 \text{ ft} \times 3 \text{ ft}$ section of wall, with $\Delta T = 50^\circ\text{F}$, will be:

- 10
 - 30
 - 500
 - 3000
 - 10,000 Btu/hr
40. Running a clothes dryer for 90 minutes at 800 Watts will cost about _____ cents if the cost of electricity is 7 cents per kWh:
- 4
 - 10
 - 24
 - 50
 - 120
- An object with a high specific heat will _____.
- lose its heat very fast
 - decrease in temperature quite fast if removed from the heat source
 - take considerably more heat to raise its temperature
 - always be water

When ice crystals form in the clouds,

45. The "R-value" of material is not related to its
- composition
 - area
 - thickness
 - resistance to heat flow
46. The temperature on an Oswego "warm" spring day has a maximum of 64°F and a minimum of 30°F. What is the number of heating degree days?
- 18
 - 30
 - 34
 - 47
 - 64
47. Infiltration in a house will _____
- increase on windy days
 - raise the heating load by about 10%
 - reduce the number of air changes
 - be increased by caulking around windows
48. The predominant method of heat transfer to a cold drink held in an evacuated bottle (a thermos) is by _____.
- conduction
 - convection
 - radiation
49. A heat pump will have an efficiency (heat out to electrical in) of about _____.
- 35%
 - 50%
 - 75%
 - 100%
 - 200%
50. Since the rate of heat transfer by conduction is proportional to the ΔT , what percent savings in your heating bill would you expect if you turned the thermostat down from 75° to 65°F, and the outside temperature is 25°F?
- 10%
 - 20%
 - 30%
 - 40%
 - 50%

49. Materials A, B, and C have R values of 1, 4, and 8 ft²-°F-hr/Btu, respectively. If the rate of heat transfer through material A alone is 20 Btu/hr, then the rate of heat transfer through the combination of A, B and C is _____.
- a. 1.5 b. 2.5 c. 4.0
d. 7.0 e. 80 Btu/hr
50. For a furnace to provide 50,000 Btu/hr of thermal energy to a living space, what should the rate of heat supplied by the fuel if the furnace efficiency is 75%?
- a. 25,000 b. 37,000 c. 50,000
d. 67,000 e. 125,000 Btu/hr
51. The cooling effect in a refrigerator is produced by _____.
- a. the electric motor which essentially converts electricity into heat
b. compression of the refrigeration gas into a liquid
c. liquefying the refrigeration gas
d. vaporization of the refrigeration liquid
e. proper insulation
52. Which of the following situations would be allowed by the second law of thermodynamics?
- a. running of a heat engine using temperature differences in the oceans
b. converting 100 joules of heat energy into 100 joules of work
c. passage of heat from the freezer into the refrigerator section
d. the reduction of waste heat from a power plant to zero with better technology
53. A heat engine _____.
- a. converts work into heat energy
b. needs a temperature difference to be able to work
c. can be 100% efficient in the absence of friction
d. needs electricity to be able to run

54. As a liquid changes into a vapor _____.
- a. heat energy is absorbed
 - b. heat energy is given off
 - c. the temperature of the liquid rises substantially
 - d. the specific heat maintains the temperature
55. The maximum efficiency of a heat engine operating between 2°C and 200°C will be about _____.
- a. 10%
 - b. 40%
 - c. 60%
 - d. 90%
 - e. 100%
56. Hot water in a _____ can will cool off faster than hot water in any other color can.
- a. white
 - b. red
 - c. black
 - d. silver
57. The primary method by which the water in a pot is heated is by _____.
- a. conduction
 - b. convection
 - c. radiation
 - d. evaporation
 - e. condensation
58. The most cost effective way to reduce heat loss from a window is _____.
- a. add a storm window
 - b. install a triple pane window
 - c. weatherstrip around the outside perimeter of the window
 - d. install a thermal drape
59. The greatest source of heat loss in a new home is from the _____.
- a. roof
 - b. walls
 - c. floor
 - d. windows
 - e. infiltration
60. Infiltration can be reduced primarily by _____.
- a. insulation
 - b. double pane windows
 - c. weatherstripping will lowering the thermostat
 - e. furnace maintenance

61. How much heat does it take to increase the temperature of 5 lbs of water by 20°F?
- a. 4 b. 25
c. 100 d. 800 Btu.
62. The greatest percentage of heat loss from an average house with 6" of fiberglass in the walls, 4" in the floor, 9" in the roof, and double pane windows, comes from the _____.
- a. roof b. walls
c. floor d. windows
63. For a cube-shaped room, 10 ft on a side, what will be the rate of heat loss if the R-value is 4 ft²-°F-hr/Btu for each side and the ΔT is 50 F?
- a. 800 b. 1200 c. 5000
d. 7500 e. 12,000 Btu/hr
64. The flow of heat in a cold soft drink will be from
- a. the drink to the ice cubes
b. the drink to the outside air
c. the drink to the glass
d. the ice cubes to the drink

Chapter 6: Solar Energy:

65. The measure of the position of the sun from the horizontal is called the _____.
- a. altitude b. azimuth
c. declination d. insolation
66. If the insolation upon a flat plate collector is 800 Btu/ft²/day, how large must the collector be to provide 30,000 Btu/hr of thermal energy for an entire day? Take the efficiency of the collector to be 50%.
- a. 150 b. 750 c. 1800
d. 4000 e. 7200 ft²