Final Exam 03

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. Which of the following is a conductor?
a. plastic
b. human body
c. glass
d. silk

____ 2. Which of the following technical terms cannot be used to describe both an electron and a photon?
a. wavelength
b. mass
c. energy
d. momentum

____ 3. You have positively charged objects. Object B has twice the charge of object A. When they are brought close together, object A experiences an electric force of 10 newtons. The magnitude of the electric force experienced by object B is _____ 10 newtons?
a. less than
b. equal to
c. greater than

____ 4. Which of the following statements about the moon is correct?
a. The moon has a constant velocity.
b. There is no net force acting on the moon.
c. The earth exerts a stronger force on the moon than the moon exerts on the earth.
d. The moon experiences a centripetal acceleration toward the earth.

____ 5. Why is it impossible to run an ocean liner by taking in seawater at the bow of the ship, extracting internal energy from the water, and dropping ice cubes off the stern?
a. This process violates the first law of thermodynamics.
b. No heat engine can operate at a single temperature.
c. Seawater does not contain enough energy.
d. The temperature of seawater is too close to freezing.

____ 6. A woman with a mass of 50 kg runs at a speed of 6 m/s and jumps onto a giant skateboard with a mass of 30 kg. What is the combined speed of the woman and the skateboard?
a. 3.75 m/s
b. 4.74 m/s
c. 6 m/s
d. 10 m/s

____ 7. If a sports car with a mass of 1000 kg travels down the road with a speed of 30 m/s, its momentum is 30,000
a. kg/(m/s)
b. kg·s/m
c. kg·m/s
d. $kg \cdot m^2/s^2$

____ 8. The latent heat of melting for water is 334 kJ/kg. How much energy would it take to melt 1 g of ice at 0° C to form water at 0° C?
a. 14 cal
b. 80 cal
c. 14,000 cal

d. 80,000 cal

____ 9. A steel railroad rail is 24.4 m long. How much does it expand during a day when the low temperature is 50° F (18° C) and the high temperature is 91° F (33° C)? Steel has a coefficient of thermal expansion of 0.000011/° C.
a. 4.0 mm
b. 4.8 mm
c. 8.7 mm
d. 9.6 mm

____ 10. Two air-track gliders are held together with a string. The mass of glider A is twice that of glider B. A spring is tightly compressed between the gliders. If the gliders are initially at rest and the spring is released by burning the string, what is the total momentum of both gliders after the release?
a. twice the momentum of A
b. half the momentum of A
c. twice the momentum of B
d. zero

____ 11. A 1400-kg car has a speed of 20 m/s. What average force is required to stop the car in 10 s?
a. 70 N
b. 700 N
c. 2800 N
d. 280,000 N

____ 12. Assume that two cars have the same mass, but that the red car has twice the speed of the blue car. We then know that the red car has _____ kinetic energy as the blue car.
a. twice as much
b. one-half as much
c. four times as much
d. one-fourth as much

____ 13. If the internal energy of an ideal gas increases by 150 J at the same time that the gas expands and does 240 J of work on its surroundings, how much heat has been added to the gas?
a. 90 J
b. 150 J
c. 240 J
d. 390 J

____ 14. A ringing bell is inserted into a large glass of water. The bell and the water are initially at the same temperature and are insulated from their surroundings. Eventually the bell stops vibrating and the water comes to rest. Which of the following statements is FALSE?
a. The mechanical energy of the bell has been completely converted into internal energy of the combined system.
b. The final temperature of the combined system is lower than the initial temperature.
c. The entropy of the combined system has increased.
d. None of the statements is false.

____ 15. If two balloons are each rubbed with wool, we find that the balloons
a. attract each other
b. do not effect each other
c. repel each other

____ 16. Assuming that a planet is in a circular orbit about the sun, what is the force that drives the planet along its orbit; that is, tangent to the circle?
a. gravity
b. magnetism
c. solar wind

d. No force is needed to drive it along its orbit.

____ 17. Which of the following sets of hypothetical observations about an object would demonstrate the existence of a third kind of electric charge?
a. It repels positive and attracts negative charges.
b. It attracts positive and repels negative charges.
c. It attracts positive and negative charges.
d. It attracts positive and negative charges and repels itself.

____ 18. An elephant, an ant, and a professor jump from a lecture table. Assuming no frictional losses, which of the following could be said just before they hit the floor?
a. They all have the same kinetic energy.
b. They all started with the same potential energy.
c. They will all experience the same force on stopping.
d. They all have the same speed.

____ 19. Which of the following statements about a cup of water and a gallon of water at the same temperature is correct?
a. They can transfer the same heat energy.
b. They have the same internal energies.
c. Their internal energies are proportional to their masses.
d. The average molecular speed in the cup of water is less.

____ 20. Two identical electroscopes, one initially charged and the other initially neutral, are connected by a thin rod. If both electroscopes are now charged, you can conclude that
a. they have the same charge
b. they have opposite charges
c. the rod is an insulator
d. one electroscope is grounded

____ 21. Astronaut Skip Parsec visits planet MSU8, which is composed of the same materials as Earth, but has twice the radius. If Skip weighs 800 newtons on Earth's surface, how much does he weigh on MSU8's surface?
a. 400 N
b. 800 N
c. 1600 N
d. 3200 N

____ 22. A refrigerator requires 400 J to extract 1000 J of energy from a cold region. How much energy does it exhaust to a hot region?
a. 400 J
b. 600 J
c. 1000 J
d. 1400 J

____ 23. When a black plastic rod is rubbed by fur, it acquires a net negative charge of 10^{-5} C. Therefore, we can conclude that the fur
a. acquired a net negative charge significantly less than 10^{-5} C.
b. also acquired a net negative charge of 10^{-5} C.
c. acquired a net positive charge significantly less than 10^{-5} C.
d. acquired a net positive charge of 10^{-5} C.

____ 24. If a hair dryer is rated at 1500 W, how much energy does it require in 5 min?
a. 300 J
b. 1500 J
c. 7500 J
d. 450,000 J

____ 25. If it takes 3400 cal to raise the temperature of a 500-g statue by 44° C, what is the specific heat of the material used to make the statue?
   a. 0.15 cal/g° C
   b. 6.8 cal/g° C
   c. 77 cal/g° C
   d. 154 cal/g° C

____ 26. What was your electric potential if a spark jumped 2 cm from your finger to a metal pipe?
   a. 30 V
   b. 60 V
   c. 30 kV
   d. 60 kV

____ 27. We are currently experiencing a world-wide energy crisis because the
   a. amount of energy in the world is decreasing rapidly.
   b. entropy of the world is increasing rapidly.
   c. entropy of the world is decreasing rapidly.
   d. amount of energy in the world is not increasing.

____ 28. When a star undergoes a supernova explosion, the total energy of the universe
   a. does not change
   b. increases
   c. decreases

____ 29. Two parallel plates have equal but opposite charges. The electric field lines near the center of the plates
   a. are perpendicular to the plates and point toward the positive one.
   b. are perpendicular to the plates and point toward the negative one.
   c. are parallel to the plates.
   d. do not exist.

____ 30. A heat engine
   a. converts thermal energy into mechanical energy.
   b. converts mechanical energy into thermal energy.
   c. violates the first law of thermodynamics.
   d. can be 100% efficient.

____ 31. What is the acceleration due to the earth's gravity at a distance of one earth radius above the earth's surface?
   a. 2.5 m/s/s
   b. 5 m/s/s
   c. 10 m/s/s
   d. 20 m/s/s

____ 32. What is the gravitational potential energy of a ball with a weight of 50 N when it is sitting on a shelf 2 m above the floor? Assume the potential energy is zero on the floor.
   a. 400 J
   b. 200 J
   c. 100 J
   d. zero

____ 33. The ratio of the electric and gravitational forces between two protons is the same for all separations because
   a. both forces vary as the inverse square of the separation.
   b. the charge-to-mass ratios are the same.
   c. the particles have the same masses.
   d. the charges are the same.

____ 34. Al the astronaut has a weight of 800 N when he is standing on the surface of the earth. What is the force of gravity acting on him when he is in a space station orbiting earth at a distance of three earth radii above the surface?

a. 800 N
b. 200 N
c. 100 N
d. 50 N

____ 35. Which of the following statements about Venus is not correct?
a. The sun's gravitational pull on Venus equals Venus' gravitational pull on the sun.
b. There is a net force acting on Venus.
c. Venus is accelerating toward the sun.
d. There is no gravity on the surface of Venus.

____ 36. Nuclear power plants are less efficient than coal-fired plants because
a. nuclear power plants have lower exhaust temperatures.
b. safety regulations require nuclear plants to run at lower temperatures.
c. there is less energy in a ton of coal than a ton of uranium.
d. coal plants produce much more carbon dioxide.

____ 37. A glass rod held in your hand can be charged by rubbing it with silk or a plastic bag. From this observation you can conclude that glass is
a. a conductor
b. an insulator
c. Nothing can be concluded.

____ 38. A toy car has a kinetic energy of 12 J. What is its kinetic energy after a frictional force of 0.6 N has acted on it for 5 m?
a. 3 J
b. 4 J
c. 6 J
d. 9 J

____ 39. Air bags are used by stunt people when they fall off buildings to reduce the _____ that occurs during the collision.
a. change in momentum
b. impulse
c. force
d. change in velocity

____ 40. You have three identical metal spheres on insulating stands. The spheres hold charges $Q_A = -2q$, $Q_B = -q$, and $Q_C = 4q$. First, sphere A is brought into contact with sphere C and separated. Second, sphere C is brought into contact with sphere B and separated. What is the resulting charge on sphere B?
a. zero
b. +q/2
c. +3q/2
d. +5q/4

____ 41. What is the de Broglie wavelength of a Volkswagen (mass = 1000 kg) traveling at 30 m/s (67 mph)? Planck's constant is 6.63×10^{-34} J·s.
a. 1.47×10^{-39} m
b. 2.21×10^{-38} m
c. 1.99×10^{-29} m
d. 2.98×10^{-28} m

____ 42. The electric potential energy of an object at point A is known to be 50 J. If it is released from rest at A, it gains 30 J of kinetic energy as it moves to point B. If the object has a charge of +2 C, what is the potential difference between points A and B?
a. 10 volts
b. 15 volts

c. 20 volts
d. 40 volts

____ 43. You have three small balls, each hanging from an insulating thread. You find that balls 1 and 2 repel one another and that balls 2 and 3 repel one another. Balls 1 and 3 will
a. attract each other.
b. repel each other.
c. neither attract or repel each other.

____ 44. A rubbed balloon "sticks" to a wall because
a. it has a negative charge that attracts the positive wall.
b. it has a positive charge that attracts the negative wall.
c. a neutral balloon attracts a charged wall.
d. it has a charge from the rubbing that attracts the neutral wall.

____ 45. What average power is required to accelerate a 1200-kg car from rest to 20 m/s in 10 s?
a. 240 W
b. 24,000 W
c. 36,000 W
d. 48,000 W

____ 46. We are led to believe that there were two kinds of charge because we are able to
a. isolate them in separate containers.
b. see two effects, attraction and repulsion.
c. detect different weights for the same object.
d. separate electrons and protons.

____ 47. Two spacecraft in outer space attract each other with a force of 20 N. What would the attractive force be if they were one-half as far apart?
a. 5 N
b. 10 N
c. 40 N
d. 80 N

____ 48. Which of the following does NOT affect the change in length of a bridge?
a. length of the bridge
b. cross-sectional area
c. type of construction material
d. change in the temperature

____ 49. On a trip to Helena, you stop for a 15-minute coffee break in Three Forks and arrive in Helena two hours after leaving Bozeman. If you assume that it is 100 miles to Helena, your average speed would be 50 mph. Which of the following statements about this trip is correct?
a. To average 50 mph the car must have gone 100 mph for 15 minutes of the trip.
b. The average speed is not 50 mph but what was indicated on the speedometer.
c. You cannot average 50 mph if the speed is zero for any part of the trip.
d. The car must have traveled faster than 50 mph for part of the trip.

____ 50. Two objects have different masses but the same momenta. If you stop them with the same retarding force, which one will stop in the shorter distance?
a. the heavier one
b. the lighter one
c. Both stop in the same distance.
d. There is not enough information to say.

____ 51. An engine exhausts 1200 J of energy for every 3600 J of energy it takes in. What is its efficiency?
a. 25 %
b. 33 %

c. 50 %
d. 67 %

____ 52. A green rod is suspended by a thread so that it can rotate freely. When we bring a neutral rod near the green rod, it is attracted. This demonstrates that the green rod
a. has a net positive charge.
b. has a net negative charge.
c. has equal numbers of positive and negative charges.
d. is charged, but not what sign the charge is.

____ 53. The earth is held in its orbit by the gravitational force of the sun. Therefore, the force that the sun exerts on the earth is _____ that the earth exerts on the sun.
a. greater than
b. smaller than
c. the same as

____ 54. You have a mass of 80 kg. How fast (in mph) would you have to run to have the same momentum as an 18-wheeler (m = 24,000 kg) rolling along at 1 mph?
a. 300 m/s
b. 3000 m/s
c. 1,920 m/s
d. 1,920,000 m/s

____ 55. A cold piece of metal is dropped into an insulated container of hot water. After the system has reach an equilibrium temperature, the
a. entropy of the metal has decreased.
b. entropy of the water has increased.
c. net change in entropy of the system is zero.
d. entropy of the system has increased.

____ 56. A charged rod held close to an uncharged conducting object will
a. repel the object
b. attract the object
c. not effect the object because the object is uncharged
d. attract the object if the rod has a positive charge and repel it if the rod has a negative charge

____ 57. Many scientists are worried about the adverse effects of global warming brought on by the greenhouse effect. What causes the greenhouse effect?
a. Green colored surfaces absorb more radiation than other colors.
b. Building houses has adverse effects on the green revolution.
c. Water vapor and carbon dioxide block infrared radiation.
d. The increased use of greenhouses to grow crops out of season.

____ 58. A metal rod held in your hand cannot be charged by rubbing it with cloth, fur, or plastic, or by contact with another charged object. From this we conclude that
a. the metal rod is a conductor.
b. your body is a conductor.
c. both the metal rod and your body are conductors.

____ 59. A 1200-kg car traveling north at 14 m/s is rear-ended by a 2000-kg truck traveling at 25 m/s. What is the total momentum before and after the collision?
a. 16,800 kg-m/s
b. 33,200 kg-m/s
c. 62,400 kg-m/s
d. 66,800 kg-m/s

____ 60. Which has the greater momentum, an 18-wheeler parked at the curb or a Volkswagen rolling down a hill?

a. 18-wheeler
b. Volkswagen
c. They are equal.
d. Could be either.

Final Exam 03
Answer Section

MULTIPLE CHOICE

1. ANS: B DIF: 1
2. ANS: B DIF: 1
3. ANS: B DIF: 1
4. ANS: D DIF: 1
5. ANS: B DIF: 1
6. ANS: A DIF: 1
7. ANS: C DIF: 1
8. ANS: B DIF: 2
9. ANS: A DIF: 2
10. ANS: D DIF: 1
11. ANS: C DIF: 2
12. ANS: C DIF: 1
13. ANS: D DIF: 1
14. ANS: D DIF: 1
15. ANS: C DIF: 1
16. ANS: D DIF: 1
17. ANS: D DIF: 2
18. ANS: D DIF: 1
19. ANS: C DIF: 1
20. ANS: A DIF: 1
21. ANS: C DIF: 2
22. ANS: D DIF: 1
23. ANS: D DIF: 1
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25. ANS: A DIF: 1
26. ANS: D DIF: 1
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33. ANS: A DIF: 1
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35. ANS: D DIF: 1
36. ANS: B DIF: 1
37. ANS: B DIF: 1
38. ANS: D DIF: 1
39. ANS: C DIF: 1
40. ANS: A DIF: 1
41. ANS: B DIF: 2

42. ANS: A DIF: 2
43. ANS: B DIF: 1
44. ANS: D DIF: 1
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46. ANS: B DIF: 1
47. ANS: D DIF: 1
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