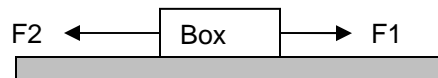


HoNoRS227 FALL 2007 Examination #1

All questions (1-50) are each worth 2 points.

- Which of the following statements best describes the scientific method?
 - The scientific method is a linear process starting with observation and following several other rigidly defined steps.
 - *The scientific method is a continuous process by which people learn about the physical universe and share their knowledge with others.
 - The scientific method allows scientists to report findings in such a way that experiments remain known only to the original experimenters.
 - The scientific method allows a scientist to ethically discard the results of an experiment and repeat the experiment when the results of an experiment do not fit the hypothesis.
 - The scientific method has no connection to the way people conduct their lives every day.
- A scientific theory is best described as being
 - an educated guess.
 - a statement that describes how a system will behave.
 - a precise mathematical equation.
 - *based on many observations and experiments.
 - an untested hypothesis.
- Which measurement of an average classroom door is closest to 2 meters?
 - Thickness
 - Width
 - *Height
 - Surface area
 - Volume
- The magnitude of the force that a baseball player exerts with a 6 kilogram baseball bat on a 0.1 kilogram ball is measured to be 60 Newtons. What is the magnitude of the force that the ball exerts on the bat?
 - 6 Newtons
 - 10 Newtons
 - 50 Newtons
 - *60 Newtons
 - 0.6 Newtons
- A group of bicycle riders took a 3 hour trip. During the first 2 hours they traveled a total of 40 kilometers. During the last hour they traveled an

- additional 10 kilometers. Which of the following values is closest to the group's average speed for the entire trip?
- A. 10 km/hr
 - *B. 16.67 km/hr
 - C. 20 km/hr
 - D. 25 km/hr
 - E. 40 km/hr
6. Which two terms represent a vector quantity and the scalar quantity of the vector's magnitude, respectively?
- A. acceleration and velocity
 - B. weight and force
 - C. speed and time
 - *D. velocity and speed
 - E. time and distance



7. In the diagram above, a box is on a frictionless horizontal surface with forces F_1 and F_2 acting as shown. If the magnitude of F_2 is greater than the magnitude of F_1 , then the box is
- A. moving at constant speed in the direction of F_1
 - B. moving at constant speed in the direction of F_2
 - C. accelerating in the direction of F_1
 - *D. accelerating in the direction of F_2
 - E. not moving at all.
8. A 5 kilogram rock and a 2 kilogram stone fall freely from rest from a height of 1000 meters. After they fall for 2 seconds, the ratio of the rock's speed to the stone's speed is
- *A. 1 to 1
 - B. 1 to 2
 - C. 2 to 1
 - D. 4 to 1
 - E. 100 to 1
9. When a satellite is a distance R from the center of Earth, the force due to gravity on the satellite is F . What is the force due to gravity on the satellite when its distance from the center of the Earth is $4R$?
- A. $9F$
 - B. $4F$
 - C. $F/4$
 - D. $F/9$
 - *E. $F/16$

10. The speed of a car is increased uniformly from 10 meters per second to 50 meters per second in 4 seconds. Which of the following is closest to the magnitude of the car's acceleration?
- A. 50 m/s²
 - B. 12.5 m/s²
 - C. 2.5 m/s²
 - *D. 10 m/s²
 - E. 40 m/s²
11. The metric unit of a Joule (J) is a unit of
- A. potential energy.
 - B. work.
 - C. kinetic energy.
 - *D. All of the above (A, B, and C) are measured in Joules.
 - E. None of the above (A, B, and C) are measured in Joules.
12. Which statement is true about the concept of power?
- A. Power is the distance over which work is done.
 - B. Power is the time at which energy is expended.
 - *C. Power is the work done per unit time.
 - D. All of the above (A, B, and C) can be said about power.
 - E. None of the above (A, B, and C) is true about power.
13. A kilowatt-hour is a unit of
- A. power.
 - *B. work.
 - C. time.
 - D. area.
 - E. volume.
14. Which of the following best describes the law of conservation of energy?
- A. Energy must not be used up faster than it is created or the supply will run out.
 - *B. Energy can be neither created nor destroyed.
 - C. Energy is conserved because it is easily destroyed.
 - D. Conservation is a law describing how to destroy matter.
 - E. Energy conservation is a law recently passed by Congress.
15. What is the work done by applying a force of 50 Newtons on a 100 kilogram object over a distance of 10 meters?
- A. 1,000 Joules
 - B. 100 Joules
 - *C. 500 Joules
 - D. 10,000 Joules
 - E. 5,000 Joules

16. What is the power consumed by a 100 Joules energy source in 4 seconds?
- A. 400 Watts
 - B. 100 Watts
 - C. 200 Watts
 - D. 50 Watts
 - *E. 25 Watts
17. What is the kinetic energy of a ball of mass 200 grams thrown with a velocity of 20 meters per second?
- A. 4,000 Joules
 - *B. 40 Joules
 - C. 20,000 Joules
 - D. 40,000 Joules
 - E. 2,000 Joules
18. Absolute zero is best described as the temperature at which
- A. water freezes at standard temperature and pressure.
 - B. water boils at standard temperature and pressure.
 - C. the molecules of a substance have maximum kinetic energy.
 - D. water can be found to be either gas, liquid or solid.
 - *E. the molecules of a substance have minimum kinetic energy.
19. Heat will always flow from object B to object A if object B has a higher
- A. mass.
 - B. total energy.
 - *C. temperature.
 - D. weight.
 - E. specific heat.
20. The heat transfer that takes place by energy moving directly from molecule to molecule is called
- *A. conduction.
 - B. convection.
 - C. radiation.
 - D. All of the above.
 - E. None of the above.
21. As a solid undergoes a phase change to a liquid state, it
- A. releases heat while remaining at a constant temperature.
 - *B. absorbs heat while remaining at a constant temperature.
 - C. releases heat as the temperature decreases.
 - D. absorbs heat as the temperature increases.
 - E. always has the same amount of heat.

22. The time required for a vibrating object to complete one full cycle is the
- A. frequency.
 - B. amplitude.
 - *C. period.
 - D. Newton.
 - E. Watt.
23. The units of cycles per second is called a
- A. Watt.
 - *B. Hertz.
 - C. Amp.
 - D. volt.
 - E. Coulumb.
24. The characteristic of a wave that is responsible for what you interpret as pitch is the wave's
- A. amplitude.
 - B. altitude.
 - *C. frequency.
 - D. height.
 - E. None of the above relates to pitch.
25. An astronomer on Earth studying light coming from a star notes that the observed light frequencies are higher than the actual emitted frequencies. The astronomer concludes that the distance between the star and the Earth is
- *A. decreasing.
 - B. increasing.
 - C. unchanging.
 - D. not able to be determined.
 - E. imaginary.
26. What is the frequency of a wave if its period is 0.2 second?
- A. 1 Hertz
 - B. 2 Hertz
 - *C. 5 Hertz
 - D. 4 Hertz
 - E. 25 Hertz
27. Equal amounts of heat energy are given off by 1 kilogram samples of aluminum ($c=0.90$), iron ($c=0.45$), platinum ($c=0.13$) and zinc ($c=0.39$). All are initially at 100°C . Which sample has the smallest decrease in temperature?
- *A. aluminum.
 - B. iron.
 - C. platinum.
 - D. zinc.
 - E. All of the samples would have the same decrease in temperature.

28. You are a chemist investigating how the chemical “sigma” affects membranes in cells. Of the following, which is the best way to express a hypothesis to serve as a basis for your investigations:
- A. Sigma affects cell membranes under some conditions in nature.
 - B. Does Sigma affect cell membranes?
 - C. Sigma could affect cell membranes under some conditions in nature.
 - *D. Sigma effects changes in cell membranes.
 - E. All of the above are equally good hypotheses.
29. Which of the following is commonly associated with pseudoscience?
- A. Astrology
 - B. Cosmetics creams
 - C. Nutrition supplements
 - D. Weight control supplements
 - *E. All of the above
30. Which of the following suggests that the acceleration of an object is directly proportional to the force acting upon it?
- A. Newton’s 1st Law of Motion
 - *B. Newton’s 2nd Law of Motion
 - C. Newton’s 3rd Law of Motion
 - D. Coulomb’s Law
 - E. Doppler Effect
31. Which of the following describes the apparent bending of waves around a corner, after passing through an opening?
- A. Reflection
 - B. Refraction
 - *C. Diffraction
 - D. Relativity
 - E. Snell’s Law
32. Which of the following is a unit of electrical current in charges per second?
- A. Volt
 - *B. Amp
 - C. Coulumb
 - D. Negative
 - E. Rate
33. Which of the following describes the apparent shift in the frequency of a wave due to the motion of the source or observer?
- A. Snell’s Law
 - B. Charles’ Law
 - C. Newton’s Law
 - D. Coulomb’s Law
 - *E. Doppler Effect

34. Which of the following describes the relationship between charge, distance and the electrical force between two objects?
- A. Snell's Law
 - B. Charles' Law
 - C. Newton's Law
 - *D. Coulomb's Law
 - E. Doppler Effect
35. In order to convert from inches to centimeters, what should you do?
- *A multiply by 2.54
 - B divide by 2.54
 - C add 2.54
 - D subtract 2.54
 - E raise the inch value to the 2.54 power
36. In order to convert from kilometers to meters, what should you do?
- A add 1000
 - B subtract 1000
 - C divide by 1000
 - *D multiply by 1000
 - E can't tell from information given
37. How do you write 12,300,000 in scientific notation?
- A 1.23×10^6
 - *B 1.23×10^7
 - C 1.23×10^8
 - D 1.23×10^9
 - E 1.23×10^5
38. All of the following are moving with a velocity of 10 m/s in the same direction. Which will have the greatest amount of kinetic energy?
- A baseball (~200 g)
 - *B bowling ball (~7 kg)
 - C pingpong ball (~20g)
 - D soccer ball (~200 g)
 - E basketball (~400 g)
39. From a physics perspective, which of the following represents work being done?
- A You attempt to open a jar of pickles but do not succeed.
 - B You hold an object in one position for three hours.
 - C You are sitting, watching a movie for two hours.
 - *D You throw a dart at a target.
 - E All of the above are examples of work.

40. A non-motorized roller coaster car starts coasting at the top of one hill, rolls down into a valley and then comes to a stop at the top of a neighboring hill. The top of the neighboring hill is at a lower elevation than the starting point. The best picture of the transfer of total energy, in this case, is described as
- A potential to kinetic and back to potential.
 - B chemical to kinetic and back to potential.
 - *C potential to kinetic and heat, and back to potential and heat.
 - D chemical to heat and back to potential.
 - E mechanical energy to heat.
41. When a meteor hits the ground it generates a lot of heat. Which of the following statements best describes this process?
- A Elastic potential energy is converted into heat.
 - B Magnetic energy is converted into heat.
 - C Chemical energy is converted into heat.
 - D Electrical potential energy is converted into heat.
 - *E Gravitational potential energy is converted into heat.
42. Einstein discovered a formula ($E = mc^2$) that showed that you could get a great deal of energy from
- A oil heat.
 - B the edge of the universe.
 - C the Milky Way galaxy.
 - *D a small amount of matter.
 - E dropping a large weight.
43. A bar magnet cut into half will always make
- A a North pole magnet
 - B a South pole magnet
 - C two magnetic monopoles
 - *D two complete magnets with both a North and South pole
 - E a paramagnet
44. What characteristic of a blackbody can you determine from knowing only the spectral peak wavelength?
- *A temperature
 - B composition
 - C phase
 - D energy
 - E density

45. Which electromagnetic radiation (of those listed) has more energy per photon than red light?
- A infrared radiation
 - B radio waves
 - C microwaves
 - *D ultraviolet radiation
 - E all of the above have the same energy
46. According to Maxwell's Laws moving electric fields always generate
- A protons
 - B neutrons
 - C electrons
 - *D magnetic fields
 - E electrostatic fields
47. An object falls from a building roof and hits the ground 6 seconds later. After release, the only force acting on it is gravity. Which value is closest to the height of the building?
- A 600 meters
 - B 60 meters
 - C 3600 meters
 - *D 180 meters
 - E 350 meters
48. Two resistors are in parallel in a simple DC circuit. One resistor is 10 ohms and the other is 20 ohms. Which value is closest to the effective resistance of the two resistors connected in parallel?
- A 15 ohms
 - *B 6.67 ohms
 - C 30 ohms
 - D 10 ohms
 - E 33.3 ohms
49. A DC circuit has a current of 10 amps and an effective resistance of 20 ohms. What is the voltage of the source supplying the circuit?
- A 30 Volts
 - B 4,000 Volts
 - C 20 Volts
 - *D 200 Volts
 - E 2,000 Volts
50. A DC circuit has a current of 10 amps and an effective resistance of 20 ohms. What is the power consumed by the circuit?
- A 300 Watts
 - B 40,000 Watts
 - *C 2,000 Watts
 - D 200 Watts
 - E 20,000 Watts

<p>MASS CONVERSIONS one mg (milligram) = 1/1000 g one g (gram) = 1000 mg, 14.4 gr, .035 oz one kg (kilogram) = 1000 g, 35 oz, 2.2 lbs one gr (grain) = 0.65 g one oz (ounce) = 28.35 g one lb (pound) = 16 oz, 454 g, .45 kg</p>	<p>LENGTH CONVERSIONS one μ (micron) = 1/1000 mm one mm (millimeter) = 1/10 cm, 1000 μ, 1/1000 m one cm (centimeter) = 10 mm, 0.39 in, 1/100 m one m (meter) = 1000 mm, 100 cm, 39.37 in one km (kilometer) = 1000 m, 3280 ft one in (inch) = 25.4 mm, 2.54 cm one ft (foot) = 12 in, 30.48 cm, 0.3m one yd (yard) = 3 ft, 91.44 cm, 0.91 m one mile = 5280 ft, 1760 yd</p>
<p>TIME CONVERSIONS one millisecond (ms) = 1/1000 sec one second (sec) = 1000 ms, 1/60 min one minute (min) = 60 seconds one hour (hr) = 60 min, 3600 sec one day = 24 hrs one year (yr) = 365.25 days</p>	<p>ANGULAR MEASURE CONVERSIONS one second (") = 1/60', 1/3600 deg one minute (') = 60", 1/60 deg one degree (deg) = 1/360 of a circle one second (sec) = 1/60 min, 1/3600 hr one minute (min) = 60 sec, 1/60 hr one hour (hr) = 15 deg</p>

Formulas that may be useful:

$$d = v \cdot t$$

$$a = (v_f - v_i) / t$$

$$v_{\text{average}} = (v_f + v_i) / 2$$

$$d = 0.5 \cdot a \cdot t^2$$

$$F = m \cdot a$$

$$w = m \cdot g$$

$$p = m \cdot v$$

$$a_r = v^2 / r$$

$$F = (m \cdot v^2) / r$$

$$v_f = (a \cdot t) + v_i$$

$$F = (G \cdot m \cdot M) / d^2$$

$$W = F \cdot d$$

$$KE = 0.5 \cdot m \cdot v^2$$

$$PE = m \cdot g \cdot h$$

$$Q = m \cdot c \cdot \Delta T$$

$$T = 1 / f$$

$$f = 1 / T$$

$$v = \lambda \cdot f$$

$$F = (k \cdot q_1 \cdot q_2) / d^2$$

$$I = q / t$$

$$V = I \cdot R$$

$$P = I \cdot V$$

$$n = c / v$$

$$E = h \cdot f$$

$$R_t = R_1 + R_2 \quad \text{or} \quad 1 / R_t = 1 / R_1 + 1 / R_2$$

Acceleration due to gravity is 9.8 m/s^2

1 kilocalorie = 4184 Joules