Name:

Physics 2130: Example Exam Chapters 6-11
Real Exam Date 22 October 2003
20 multiple choice questions worth 5 points each.

1. A 75-kg swimmer dives horizontally off a 500-kg raft. The diver's speed immediately after leaving the raft is 4.0 m/s. A micro-sensor system attached to the edge of the raft measures the time interval during which the diver applies an impulse to the raft just prior to leaving the raft surface. If the time interval is read as 0.20 s, what is the magnitude of the average horizontal force by diver on the raft?

   a. 900 N

   b. 450 N

   c. 525 N

   d. 1 500 N

2. During a snowball fight two balls with masses of 0.4 and 0.6 kg, respectively, are thrown in such a manner that they meet head-on and combine to form a single mass. The magnitude of initial velocity for each is 15 m/s. What is the speed of the 1.0-kg mass immediately after collision?

   a. zero

   b. 3 m/s

   c. 6 m/s

   d. 9 m/s

3. In a two-body collision, if the momentum of the system is conserved, then which of the following best describes the kinetic energy after the collision?

   a. must be less

   b. must also be conserved

   c. may also be conserved

   d. is doubled in value

4. A machine gun is attached to a railroad flatcar that rolls with negligible friction. If the railroad car has a mass of 6.25×10^4 kg, how many bullets of mass 25 g would have to be fired at 250 m/s off the back to give the railroad car a forward velocity of 0.5 m/s?

   a. 400

   b. 2 000

   c. 3 000

   d. 5 000

5. A ventilation fan has blades 0.25 m long rotating at 20 rpm. What is the centripetal acceleration of a point on the outer tip of a blade?

    a. 1.1 m/s^2

    b. 0.87 m/s^2

    c. 0.55 m/s^2

    d. 0.23 m/s^2

6. A 0.30-m-radius automobile tire rotates how many rad after starting from rest and accelerating at a constant 2.0 rad/s^2 over a 5.0-s interval?

    a. 12.5 rad

    b. 25 rad

    c. 2.0 rad

    d. 0.50 rad

7. An object of mass 0.50 kg is transported to the surface of Planet X where the object?s weight is measured to be 20 N. The radius of the planet is 4.0×10^6 m. What free fall acceleration will the 0.50-kg object experience when at the surface of Planet X?

    a. 48 m/s^2

    b. 20 m/s^2

    c. 16 m/s^2

    d. 40 m/s^2

8. A ventilation fan with a moment of inertia of 0.034 kg-m^2 has a net torque of 0.11 N-m applied to it. If it starts from rest, what angular momentum will it have 8.0 s later?

    a. 0.88 kg-m^2/s

    b. 0.97 kg-m^2/s

    c. 2.0 kg-m^2/s

    d. 3.25 kg-m^2/s

9. An 800-N billboard worker stands on a 4.0-m scaffold weighing 500 N and supported by vertical ropes at each end. How far would the worker stand from one of the supporting ropes to produce a tension of 550 N in that rope?

   a. 1.4 m

   b. 2.0 m

   c. 2.5 m

   d. 2.7 m

10. A copper wire of length 4.0 m, cross sectional area $7.1 \times 10^{-6} m^2$ and Young?s modulus 11×10^{10} N/m^2 has a 200-kg load hung on it. What is its increase in length? ($g = 9.8$ m/s^2)

   a. 1.0 mm

   b. 2.0 mm

   c. 5.0 mm

   d. 10.0 mm

11. A piece of aluminum has density 2.70 g/cm3 and mass 775 g. The aluminum is submerged in a container of oil of density 0.650 g/cm^3. A spring balance is attached with string to the piece of aluminum. What reading will the balance register in grams (g) for the submerged metal?

   a. 960 g

   b. 775 g

   c. 588 g

   d. 190 g

12. The bottom of a flat-bottomed aluminum boat has an area of 4.0 m^2 and the boat's mass is 60 kg. When set afloat in water, how far below the water surface is the boat bottom? (water density $= 1.0 \times 10^3$ kg/m^3)

   a. 0.060 m

   b. 0.015 m

   c. 0.030 m

   d. 0.075 m

13. The flow rate of a liquid through a 2.0-cm-radius pipe is 0.008 0 m³/s. The average fluid speed in the pipe is:

    a. 0.64 m/s

    b. 2.0 m/s

    c. 0.040 m/s

    d. 6.4 m/s

14. A rectangular steel plate with dimensions of 30 cm x 25 cm is heated from $20C°$ to $220C°$. What is its change in area? (Coefficient of linear expansion for steel is $11 \times 10^{-6}/C°$.)

    a. 0.82 cm²

    b. 1.65 cm²

    c. 3.3 cm²

    d. 6.6 cm²

15. An ideal gas is confined to a container with adjustable volume. The pressure and mole number are constant. By what factor will volume change if absolute temperature triples?

    a. 1/9

    b. 1/3

    c. 3.0

    d. 9.0

16. What is the temperature of a system in thermal equilibrium with another system made up of ice and water at one atmosphere of pressure?

    a. $0F°$

    b. 273 K

    c. 0 K

    d. $100C°$

17. Dmitri places one end of a copper rod in a heat reservoir and the other end in a heat sink. By what factor is the rate of heat flow changed when the temperature difference between the reservoir and sink is tripled?

    a. 0.33

    b. 1/9

    c. 3.0

    d. 9.0

18. Which one of the following processes of heat transfer requires the presence of a fluid?

    a. conduction

    b. radiation

    c. convection

    d. none of the above choices are valid

19. An inventor develops a stationary cycling device by which an individual, while pedaling, can convert all of the energy expended into heat for warming water. How much mechanical energy is required to increase the temperature of 300 g of water (enough for 1 cup of coffee) from $20C°$ to $95C°$? (1 cal = 4.186 J, the specific heat of water is 4 186 J/kg-$C°$)

    a. 94 000 J

    b. 22 000 J

    c. 5 400 J

    d. 14 J

20. An object at $27C°$ has its temperature increased to $37C°$. The power then radiated by this object increases by how many percent?

    a. 3.3

    b. 14

    c. 37

    d. 253