Name:_____Student ID#_____ ID CODE A

Section #_____TA Name_____

Fill in your name, student ID # (not your social security #), and section # (under ABC of special codes) on the Scantron sheet. Be sure to fill in the letter for the ID code on the upper right of this page for the first question. This determines which version of the test you took, and it is very important to get this correct. Make sure your exam has questions 2-33 and 9 total pages.

Physics 103 Final Examination May 14, 2007

Multiple Choice, Closed Book

Circle the letter of the choice that best completes the statement or answers the question and also mark this answer on your Scantron sheet. You must do both.

Please be very careful with the first question:

1. ENTER THE ID CODE ABOVE IN THE UPPER RIGHT CORNER
- **A.** ID Code A
- **B.** ID Code B
- **C.** ID Code C
- **D.** ID Code D
- **E.** ID Code E

2. If the displacement of an object, x, is related to velocity, v, according to the relation $x = Av$, the constant, A, has the dimension of which of the following?

    a. velocity
    b. acceleration
    c. length
    d. time
    e. area

3. An object moves 20 m east in 30 s and then returns to its starting point taking an additional 50 s. If west is chosen as the positive direction, what is the sign associated with the average velocity of the object?

    a. +
    b. –
    c. 0 (no sign)
    d. any of the above
    e. can not be determined from the information given

4. A European sports car dealer claims that his product will accelerate at a constant rate from rest to a speed of 100 km/hr in 8.00 s. What is the speed after the first 5.00 s of acceleration? (*Hint:* First convert the speed to m/s.)

    a. 34.7 m/s
    b. 14.7 m/s
    c. 44.4 m/s
    d. 28.7 m/s
    e. 17.4 m/s

5. Omar throws a rock straight down with an initial speed of 12 m/s from the top of a tower. The rock hits the ground after 2.0 s. What is the height of the tower? (air resistance is negligible)

    a. 20 m
    b. 24 m
    c. 30 m
    d. 44 m
    e. 63 m

6. A student adds two vectors with magnitudes of 200 and 40. Which one of the following is the only possible choice for the magnitude of the resultant?

    a. 100
    b. 220
    c. 260
    d. 140
    e. 40

7. A stone is thrown with an initial speed of 15 m/s at an angle of 53° above the horizontal from the top of a 35 m building. If $g = 9.8$ m/s^2 and air resistance is negligible, then what is the magnitude of the vertical velocity component of the rock as it hits the ground?

    a. 2.3 m/s
    b. 9.0 m/s
    c. 18 m/s
    d. 26 m/s
    e. 29 m/s

8. An automobile of mass 2000 kg moving at 30 m/s is braked suddenly with a constant braking force of 10,000 N. How far does the car travel before stopping?

    a. 45 m
    b. 90 m
    c. 135 m
    d. 180 m
    e. 235 m

9. A girl is using a rope to pull a box that weighs 300 N across a level surface with constant velocity. The rope makes an angle of 30° above the horizontal, and the tension in the rope is 100 N. What is the normal force of the floor on the box?

    a. 100 N
    b. 300 N
    c. 86 N
    d. 50 N
    e. 250 N

10. Which of the following is that form of energy associated with an object's location in a conservative force field?

    a. potential
    b. electrical
    c. thermal
    d. bio-chemical
    e. kinetic

11. What is the minimum amount of energy required for an 80-kg climber carrying a 20-kg pack to climb Mt. Everest, 8850 m high?

    a. 8.7 MJ
    b. 4.2 MJ
    c. 0.50 MJ
    d. 2.5 MJ
    e. 1.0 MJ

12. A 75-kg swimmer dives horizontally off a 500-kg raft. If the diver's speed immediately after leaving the raft is 4 m/s, what is the corresponding raft speed?

    a. 0.2 m/s
    b. 0.5 m/s
    c. 0.6 m/s
    d. 2.0 m/s
    e. 4.0 m/s

13. The kinetic energy of an object is quadrupled. Its momentum will change by what factor?

    a. zero
    b. two
    c. three
    d. eight
    e. four

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

    a. 12 radians
    b. 25 radians
    c. 2.0 radians
    d. 0.50 radians
    e. 1.0 radian

15. An airplane flying in a loop can simulate weightlessness inside the aircraft cabin at the top of the loop. What must be the radius of curvature of the flight path for an aircraft moving at 150 m/s to create a condition of "weightlessness" inside the aircraft?

    a. 1150 m
    b. 1800 m
    c. 2000 m
    d. 2300 m
    e. 3600 m

16. A uniform bridge span weighs 50.0×10^3 N and is 40.0 m long. An automobile weighing 15.0×10^3 N is parked with its center of gravity located 12.0 m from the right pier. What upward support force does the left pier provide?

    a. 29.5×10^3 N
    b. 35.5×10^3 N
    c. 65.0×10^3 N
    d. 32.5×10^3 N
    e. 25.5×10^3 N

17. If a net torque is applied to an object, that object will experience:

    a. an increasing angular acceleration.
    b. a constant angular speed.
    c. a constant angular acceleration.
    d. a constant moment of inertia.
    e. an increasing moment of inertia.

18. A large stone is resting on the bottom of the swimming pool. The normal force of the bottom of the pool on the stone is equal to the:

    a. mass of the stone
    b. weight of the stone.
    c. weight of the water displaced.
    d. sum of the weight of the stone and the weight of the displaced water.
    e. difference between the weight of the stone and the weight of the displaced water.

19. A hole is poked through the metal side of a drum holding water. The hole is 18 cm below the water surface. What is the initial speed of outflow?

    a. 1.5 m/s
    b. 1.9 m/s
    c. 3.0 m/s
    d. 3.2 m/s
    e. 3.5 m/s

20. The absolute temperature of an ideal gas is directly proportional to which of the following properties, when taken as an average, of the molecules of that gas?

    a. speed
    b. momentum
    c. mass
    d. kinetic energy
    e. potential energy

21. 9.0 g of water in a 2.0-L pressure vessel is heated to 500°C. What is the pressure inside the container? (R = 0.082 L·atm/mol·K, one mole of water has a mass of 18 grams)

    a. 7.9 atm
    b. 16 atm
    c. 20 atm
    d. 24 atm
    e. 32 atm

22. 25 grams of a solid at 70°C is placed in 100 grams of a fluid at 20°C. Thermal equilibrium is reached at 30°C. The specific heat of the solid:

    a. is equal to that of the fluid.
    b. is less than that of the fluid.
    c. is more than that of the fluid.
    d. cannot be compared to that of a material in a different phase.
    e. specific heat is not a property of solids.

23. A 0.0030-kg lead bullet is traveling at a speed of 240 m/s when it embeds in a block of ice at 0°C. If all the heat generated goes into melting ice, what quantity of ice is melted? (L_f = 80 kcal/kg for ice and 1 kcal = 4 186 J)

    a. 1.0×10^{-2} kg
    b. 1.5×10^{-2} kg
    c. 5.8×10^{-4} kg
    d. 3.2×10^{-3} kg
    e. 2.6×10^{-4} kg

24. In an isothermal process for an ideal gas system (where the internal energy doesn't change), which of the following choices best corresponds to the value of the work done on the system?

    a. its heat intake
    b. twice its heat intake
    c. the negative of its heat intake
    d. twice the negative of its heat intake
    e. is zero

25. An electrical generating plant operates at a boiler temperature of 220°C and exhausts the unused heat into a nearby river at 19°C. If the generating plant has a power output of 800 megawatts (MW) and if the actual efficiency is 3/4 the theoretical efficiency, how much heat per second must be delivered to the boiler?

    a. 5200 MW
    b. 1800 MW
    c. 2400 MW
    d. 3600 MW
    e. 2600 MW

26. A mass of 0.40 kg, attached to a spring with a spring constant of 80 N/m, is set into simple harmonic motion. What is the magnitude of the acceleration of the mass when at its maximum displacement of 0.10 m from the equilibrium position?

    a. zero
    b. 5 m/s^2
    c. 10 m/s^2
    d. 15 m/s^2
    e. 20 m/s^2

27. A 0.20 kg object, attached to a spring with spring constant k = 10 N/m, is moving on a horizontal frictionless surface in simple harmonic motion of amplitude of 0.080 m. What is its speed at the instant when its displacement is 0.040 m?

    a. 19.6 m/s
    b. 9.8 m/s
    c. 4.9 m/s
    d. 0.49 m/s
    e. 0.24 m/s

28. For a mass suspended on a spring in the vertical direction, the time for one complete oscillation will depend on:

    a. the value for g (the acceleration due to gravity).
    b. the distance the mass was originally pulled down.
    c. the maximum speed of the oscillating mass.
    d. the time doesn't depend on any of the above.
    e. the time depends on all of the above(a-c)

29. If a radio wave($v = 3.00 \times 10^8$ m/s) has frequency 94.7 MHz, what is its wavelength?

    a. 8.78 m
    b. 1.20 m
    c. 2.00 m
    d. 2.50 m
    e. 3.17 m

30. The crests and troughs of a sound wave corresponds to:

    a. places where the sound is louder and softer
    b. rarefactions and compressions.
    c. point where molecules vibrate at a right angle to the direction of wave travel.
    d. region of low elasticity.
    e. none of the above

31. The speed of sound in air at 0°C is 331 m/s. What is the speed of sound at 25.0°C?

    a. 310 m/s
    b. 346 m/s
    c. 356 m/s
    d. 343 m/s
    e. 350 m/s

32. A sound source of frequency 1000 Hz moves at 50.0 m/s toward a listener who is at rest. What is the apparent frequency heard by the listener? (speed of sound = 331 m/s)

    a. 853 Hz
    b. 1000Hz
    c. 872 Hz
    d. 1150 Hz
    e. 1170 Hz

33. Two tuning forks sounding together result in a beat frequency of 3 Hz. If the frequency of one of the forks is 256 Hz, what is the frequency of the other?

    a. 262 Hz or 250 Hz
    b. 105 Hz
    c. 259 Hz or 253 Hz
    d. 85 Hz
    e. 512 Hz