

TENNESSEE STATE UNIVERSITY
PHYSICS 2010
FINAL EXAMINATION, FALL 2007

Name _____ Instructor _____
ID# _____ Date 12-07-07 Score _____

DIRECTIONS: Each of the problems below is followed by a list of possible answers. Select the best possible answer, and shade in the corresponding alphabet on the sheet provided. Each problem is worth ten (10) points for a total of 300 points. Any kind of cheating will give you an 'F'-grade. Other instructions will be given in the EXAM HALL, if necessary.

1. Which of the following products of ratios gives the conversion factor to convert miles per

hour $\left(\frac{\text{mi}}{\text{h}}\right)$ to meters per second $\left(\frac{\text{m}}{\text{s}}\right)$?

- a. $\frac{5280 \text{ f}}{\text{mi}} \cdot \frac{12 \text{ in}}{\text{f}} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} \cdot \frac{1 \text{ m}}{100 \text{ cm}} \cdot \frac{1 \text{ h}}{3600 \text{ s}}$ b. $\frac{5280 \text{ f}}{\text{mi}} \cdot \frac{12 \text{ in}}{\text{f}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}} \cdot \frac{100 \text{ cm}}{1 \text{ m}} \cdot \frac{1 \text{ h}}{3600 \text{ s}}$
- c. $\frac{1 \text{ mi}}{5280 \text{ f}} \cdot \frac{1 \text{ f}}{12 \text{ in}} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} \cdot \frac{100 \text{ cm}}{1 \text{ m}} \cdot \frac{3600 \text{ s}}{1 \text{ h}}$ d. $\frac{5280 \text{ f}}{\text{mi}} \cdot \frac{12 \text{ in}}{\text{f}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}} \cdot \frac{1 \text{ m}}{100 \text{ cm}} \cdot \frac{1 \text{ h}}{3600 \text{ s}}$
- e. $\frac{5280 \text{ f}}{\text{mi}} \cdot \frac{12 \text{ in}}{\text{f}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}} \cdot \frac{1 \text{ m}}{100 \text{ cm}} \cdot \frac{3600 \text{ s}}{1 \text{ h}}$

2. The density of an object is defined as:

- a. the volume occupied by each unit of mass. b. the amount of mass for each unit of volume.
c. the weight of each unit of volume. d. the amount of the substance that has unit volume and unit mass.
e. the amount of the substance that contains as many particles as 12 grams of the carbon-12 isotope.

3. Two objects, one with a mass of 2 kg and one with a mass of 1 kg, fall from rest with no air resistance. Which of the following statements is true?

- a) The heavier one falls twice as fast, because it has twice the mass.
b) The heavier one falls one-half as fast, because it has twice the inertia.
c) They both fall at the same rate. d) None of the above.

4. Your car rolls along at constant velocity. The net force on your car is:

- a. zero b. from the engine, pushing you forward
c. from the tires, pushing you forward d. from air resistance

5. A person stands (motionless) on a table. There are two forces acting on the person – the gravitational pull of the Earth, and the normal force from the table. Which of the following statements is true?

- a. The two forces are not an action-reaction pair, because they act on the same object.
b. The two forces are an action-reaction pair, because they are equal and opposite.
c. The two forces are not an action reaction pair, because they are not equal and opposite
d. The two forces are an action-reaction pair, because they act on the same object.

6. An object slides on a level, rough surface and comes to a stop. When it started moving, it had some amount of kinetic energy. When it stops, its kinetic energy is zero. What happened to the energy?

- a. it turned into heat, sound, and other forms of energy
- b. it just got used up – it no longer exists in any form
- c. it turned into potential energy
- d. none of the above

7. A fly hits (and sticks to) the windshield of a heavy truck sitting on frictionless ice. Which of the following statements is true?

- a. The truck is too heavy to move, so momentum is not conserved in this collision.
- b. The truck moves, just a little, because momentum is conserved.
- c. The truck moves, just a little, but because the mass difference is so great, momentum is not conserved.
- d. The truck does not move, but momentum is still conserved.

8. A mass oscillates on a spring, undergoing simple harmonic motion. If the mass has a larger amplitude of oscillation (but the motion is still simple harmonic), the period:

- a. increases
- b. decreases
- c. remains the same
- d. not enough information to decide

9. A sound wave has a certain intensity. In order to increase the intensity, you should:

- a. increase the pitch
- b. decrease the pitch
- c. decrease the pressure change in the wave
- d. increase the pressure change in the wave

The following situation applies to problems 10 and 11. F_1 is in the x direction, and so on.

Three applied forces, $F_1 = 20.0$ N, $F_2 = 40.0$ N, and $F_3 = 10.0$ N act on an object with a mass of 2.00 kg which can move along an inclined plane as shown in the figure. The questions refer to the instant when the object has moved 0.600 m along the surface of the inclined plane in the upward direction. Neglect friction and use $g = 10.0$ m/s².

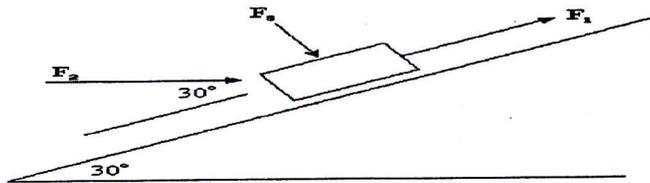


Figure 1

10. Refer to Figure 1. What is the amount of work done by force F_1 as the object moves up the inclined plane?

- a. 12.0 J
- b. 10.0 J
- c. 0 J
- d. 11.0 J
- e. 16.0 J

11. Refer to Figure 1. What is the amount of work done by force F_2 as the object moves up the inclined plane?

- a. 24.0 J
- b. 0 J
- c. 20.8 J
- d. 12.0 J
- e. 16.0 J

12. A bullet is fired with a certain velocity at an angle θ above the horizontal at a location where $g = 10.0$ m/s². The initial x and y components of its velocity are 86.6 m/s and 50.0 m/s respectively. How long does it take before the bullet gets to the highest point of its trajectory?

- a. 20.0 seconds
- b. 10.0 seconds
- c. 5.0 seconds
- d. 15.0 seconds
- e. None of the other choices is correct.

13. A man is holding an 8.00 -kg vacuum cleaner at arm's length, a distance of 0.550 m from his shoulder. What is the torque on the shoulder joint if the arm is held at 30.0° below the horizontal?

- a. 4.40 Nm
- b. 37.4 Nm
- c. 2.20 Nm
- d. 21.6 Nm
- e. 12.6 Nm

14. A wheel that is rotating at 33.3 rad/s is given an angular acceleration of 2.15 rad/s^2 . Through what angle has the wheel turned when its angular speed reaches 72.0 rad/s?

- a. 316 rad b. 66.8 rad c. 948 rad d. 83.2 rad e. 697 rad

15. The moment of inertia of a solid cylinder about its axis is given by $0.5 MR^2$. If this cylinder rolls without slipping, the ratio of its rotational kinetic energy to its translational kinetic energy is:

- a. 1:3 b. 1:2 c. 1:1 d. 2:1 e. 3:1

16. A displacement vector is 34.0 m in length and is directed 60.0° east of north. What are the components of this vector?

Choice	Northward component	Eastward component	Choice	Northward component	Eastward component
1	29.4 m	17.0 m	4	17.0 m	29.4 m
2	18.2 m	28.1 m	5	23.6 m	16.3 m
3	22.4 m	11.5 m			

- a. Choice 1 b. Choice 2 c. Choice 3 d. Choice 4 e. Choice 5

17. A car traveling at 30.0 m/s when the driver suddenly applies the breaks, giving it a constant deceleration. The car comes to a stop in a distance of 120.0 m. What is the deceleration of the car?

- a. 4.00 m/s^2 b. 3.75 m/s^2 c. 4.25 m/s^2 d. 4.75 m/s^2 e. 4.50 m/s^2

18. You turn a circular corner in your car. Your speedometer does not change. Which of the following statements is true?

- a. There is a net force acting towards the center of the circle.
 b. There is no net force – your speed does not change, so your acceleration is zero.
 c. There is a net force acting away from the center of the circle
 d. Not enough information to decide.

19. A boy jumps at a speed of 16.0 m/s at an angle of 20.0° above the horizontal. How long does he stay in the air before touching the ground?

- a. 1.12 s b. 3.07 s c. 4.2 s d. 0.56 s e. 1.53 s.

20. A 1200-kg car is pulling a 500-kg trailer along level ground. Friction is negligible. The car accelerates with an acceleration of 1.3 m/s^2 . What is the force exerted by the car on the trailer?

- a. 700 N b. 600 N c. 750 N d. 550 N e. 650N

21. A person carries a mass of 10 kg and walks along the + x-axis for a distance of 100 m with a constant velocity of 2 m/s. What is the work done by this person?

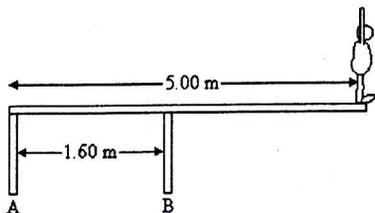
- a. 200 J b. 20 J c. 1000 J d. 0 J e. None of the other choices is correct.

22. A 20-kg object is resting at the top of a table 1.6 m above ground level. The object is then picked up and moved to a height of 8.7 m above ground level. What is the change in the gravitational potential energy of this object? Use $g = 10 \text{ m/s}^2$.

- a. 140 J b. 71 J c. 1420 J d. 320 J e. 1740 J

23. A 0.330-kg volleyball is dropped from rest. It takes it 1.30 s to reach the ground. What is the magnitude of its momentum just before it hits the ground?

- a. 1.18 kg.m/s b. 4.21 kg.m/s c. 2.11 kg.m/s d. 3.24 kg.m/s e. 0.429 kg.m/s



24. An 82.0 kg diver stands at the edge of a light 5.00-m diving board, which is supported by two pillars 1.60 m apart, as shown in the figure above. Find the force exerted by pillar A.

- a. 1.71 kN down b. 1.71 kN up c. 2.51 kN up d. 3.44 kN up e. 2.51 kN down

25. A ball is thrown straight up in the air. When the ball reaches its highest point, which of the following is true?

- (A) It is in equilibrium.
 (B) It has zero acceleration
 (C) It has maximum momentum.
 (D) It has maximum kinetic energy.
 (E) None of the above

26. If a vector A has components $A_x > 0$, and $A_y < 0$, then the angle that this vector makes with the positive x-axis must be in the range

- a. 0° to 90° b. 90° to 180° c. 180° to 270° d. 270° to 360° e. cannot be determined without additional information.

27. You wish to double the speed of a wave in a string by tightening it. By what factor must you increase the tension in the string?

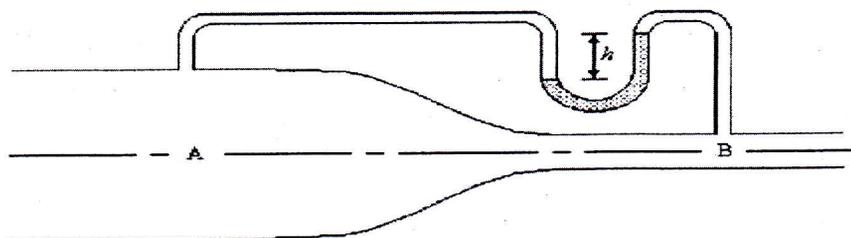
- a. $\sqrt{2}$ b. $\sqrt{4}$ c. 2 d. 4 e. none of the above

28. A car horn emits a frequency of 400 Hz. A car traveling at 20.0 m/s sounds the horn as it approaches a stationary pedestrian. What frequency does the pedestrian hear? The speed of sound in air is 343 m/s.

- a. 375 Hz b. 200 Hz c. 400 Hz d. 425 Hz e. 450 Hz

29. The bathyscaphe Trieste consists of a cylindrical hull, 15.2 m long and 3.66 m in diameter, filled with gasoline with a density of 880 kg/m^3 to make it buoyant. If it is totally submerged in salt water with a density of 1025 kg/m^3 and neither rising nor sinking, what is the weight of the craft?

- a. 127 kN b. 327 kN c. 227 kN d. 527 kN e. 427 kN



30. Water flows in the horizontal pipe shown in the figure above. At A the diameter is 5.00 cm and at B the diameter is 4.00 cm. The fluid in the manometer is mercury, which has a density of $13,600 \text{ kg/m}^3$. The manometer reading h is 4.20 cm. What volume of water is flowing through the pipe per second?

- A) 0.0206 m³/s B) 0.00547 m³/s C) 0.372 m³/s D) 0.186 m³/s