PHYS 201 Test #2 Fall 2016 Name: KEY

A. For the MC questions write your answers in the line next to the question number. Other questions/Problems provide your answers in the space below them.

b 1. Which one of the following objects has the least inertia?
a. space shuttle b. book c. bicycle d. car e. jetliner

d 2. The push or pull on an object can be best described by what scientific term?
a. Friction b. motion c. gravity d. force e. mass

c 3. Newton's first law of motion states that a body in motion does what if it is not acted on by a net force?
a. Comes to rest b. Changes direction
c. Maintains a constant velocity d. Increases inertia

e 4. Which one of the following is Newton's third law motion?
a. Every particle in the universe exerts a repulsive force on every other particle
b. Every particle in the universe exerts an attractive force on every other particle
c. An object will remain in a state of rest or of uniform motion in a straight line unless acted on by an outside net force.
d. The net force acting on an object is equals to the product of the mass of the object and the acceleration of the object.
e. When one object exerts a force on a second object, the second object exerts a force on the first that has an equal magnitude but opposite direction.
f. Frictional forces are in the opposite direction of motion.

d 5. If a constant, nonzero force is applied to an object that is at rest, what can you say about the velocity and acceleration of the object after the force is applied?
a. velocity changes, acceleration changes
b. velocity remains constant, acceleration remains constant
c. velocity remains constant, acceleration changes
d. velocity changes, acceleration remains constant

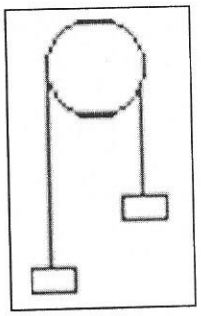
d 6. Which one of the following is also the unit watt, W?
f 7. Which one of the following is a unit for momentum?
b 8. Which one of the following is a unit for the gravitational constant, G?
Answers for 6-8
a. $kg.m/s^2$ b. $m^3/(kg.s^2)$ c. $kg.m^2/s^2$ d. $kg.m^2/s^3$ e. $kg.m/s^3$ f. kg.m/s

f 9. Which one of the following is an example for a conservative force?
a. pushing b. static frictional force c. Tension
d. kinetic frictional force e. normal force f. gravitational force

c 10. Which one of the following is a fundamental force?
a. tension b. normal force c. strong nuclear force
d. frictional force e. elastic spring force

C 11. A person with a black belt in karate has a fist that has a mass of 0.70 kg. Starting from rest, this fist attains a velocity of 6.0 m/s in 0.15 s. What is the magnitude of the net force applied to the fist to achieve this?

a. 6.9 N b. 4.2 N c. 28 N d. 5.6 N e. 40 N



a 12. Two masses (3-kg and 5-kg) are attached by a massless cord passing over a massless, frictionless pulley of an Atwood's machine and released. What will be the acceleration of the masses?

a. 2.45 m/s^2 b. 9.8 m/s^2
c. 3.92 m/s^2 d. 6.53 m/s^2

d 13. What is the centripetal force for ISS in orbit around the Earth?

a. Normal force b. Kinetic frictional force
c. Static frictional force d. Gravitational force

C 14. Which one of the following terms is used to indicate the natural tendency of an object to remain at rest or in motion at a constant speed along a straight line?

a. Velocity b. Speed c. Inertia d. Force e. Acceleration

a 15. Sally wants to push a box across the floor. She has a hard time getting the box to start moving, but finds it easy to push it the rest of the way. What can you infer from this example about the relationship between kinetic friction and static friction?

a. Kinetic friction is less than static friction.
b. Kinetic friction is equal to static friction.
c. Kinetic friction is greater than static friction.

a 16. What is the angle between the centripetal acceleration and centripetal force?

d 17. What is the angle between the frictional force and displacement?

Answers for 16 & 17

a. 0 b. 30^0 c. 90^0 d. 180^0 e. 270^0

C 18. A box weighing 500N is at rest on the floor. A person pushes against it and it starts moving when 100N force is applied to it. What can be said about the coefficient of kinetic friction between the box and the floor?

a. $\mu_k = 0$ b. $\mu_k = 0.2$ c. $\mu_k < 0.2$ d. $\mu_k > 0.2$

b 19. A 10 kg rock falls from a 20 m cliff. What are the kinetic and potential energy when the rock has fallen 5 m?

a. KE = 980 J, PE= 980 J b. KE= 490 J, PE = 1470 J
c. KE = 1470 J, PE= 490 J d. KE= 1960 J, PE = 0 J

C 20. How are mass and Earth's gravitational force on a body related?

a. They are inversely proportional b. They are not related.
c. They are directly proportional d. They are the same thing.

b 21. Which of the following is an example of a perfectly inelastic collision?

a. A hockey puck crashes into a wall and bounces backwards.

b. A bullet is shot and lodges into a wooden block.

c. Two bumper cars collide and split off in different directions.

a 22. What is represented by the area under the Force VS. Time graph?

a. Impulse b. Work c. Acceleration d. Velocity

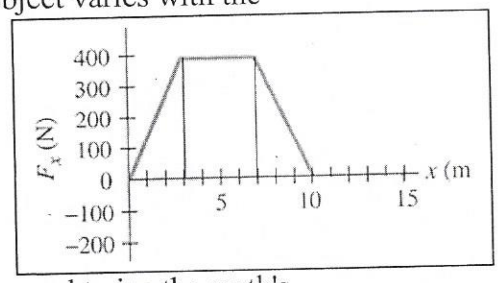
C 23. A volleyball of mass 0.35 kg is spiked so that its incoming velocity of -15 m/s is changed to an outgoing velocity of +12 m/s. What impulse does the player apply to the ball?

a. 4.2 kg.m/s b. -5.3 kg.m/s c. 9.5 kg.m/s d. -9.5 kg.m/s e. 1.1 kg.m/s f. -1.1 kg.m/s

C 24. Two pucks collide on an air hockey table and bounce off each other in opposite directions. Each puck has a mass of 0.2 kg. Puck 1 has an initial velocity of 10 m/s, and puck 2 has an initial velocity of −25 m/s. After the collision, puck 1 recoils with a velocity of −5 m/s. What is the final velocity of puck 2?

a. 40 m/s b. 10 m/s c. -10 m/s d. - 40 m/s

e 25. The net force component along the displacement of the object varies with the magnitude of the displacement as shown in the drawing.
How much work is done in moving the object from 0 to 10.0 m?



a. 4000 J b. 600 J c. 1200 J
d. 1600 J e. 2800 J

a 26. In another solar system a planet has twice the earth's mass and twice the earth's radius. Your weight on this planet is _____ times your earth-weight.

a. 0.5 b. 1 c. 2 d. 4 e. 8 f. 10

b 27. An engineer is asked to design a playground slide such that the speed a child reaches at the bottom does not exceed 7.0 m/s. Determine the maximum height that the slide can be.

a. 1.8 m b. 2.5 m c. 3.2 m d. 4.5 m e. 7.4 m

B 28. Estimate the cost of electricity for operating ten 60-W incandescent light bulb for 4 hours a day for 20 days a month for one year. Assume a cost of 9 cents per kWh.

A. $ 57.6 B. $ 51.8 C. $ 1.29 D. 52 cents E. $ 5.18

d 29. Which one of the following energy transformation takes place in a microphone?

a. Radiant energy is converted into electrical energy

b. Electrical energy is converted into mechanical energy

c. Radiant energy is converted into thermal energy

d. Mechanical energy is converted into electrical energy

e. Electrical energy is converted into radiant energy

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II. A 35-kg box is pulled along a horizontal surface at a constant velocity. The pulling force has a magnitude of 80 N, which is applied at a 30^0 angle as shown below. Frictional force is also present.

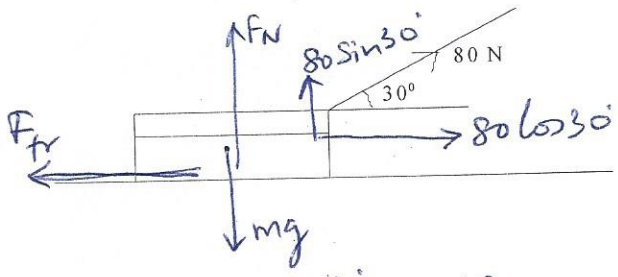
a. Draw a free-body diagram for the box.

b. Resolve the 80-N force into horizontal and vertical components, in the diagram.

c. Determine the normal force.

d. Determine the frictional force.

e. Determine the coefficient of kinetic friction between the box and surface.



c. $F_N + 80\sin30^\circ = mg$

$F_N = mg - 80\sin30^\circ = 35\times9.8 - 80\times0.5 = 303\,N$

$F_N = 303\,N$

d. $F_{fr} = 80\cos30^\circ = 69.3\,N$

e. $\mu_k = \frac{F_{fr}}{F_N} = \frac{69.3}{303} = 0.23 = 0.229$

$\mu_k = 0.23$

10

III. Newton's law of gravitation is given: $F = G\frac{m_1 m_2}{r^2}; G = 6.673\times10^{-11}(SI)$.

a. Define weight. weight = force of gravity
= mg

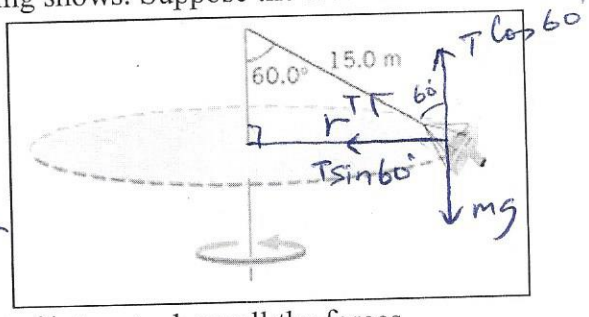
b. Calculate the surface gravity for the planet Venus. (Mass of Venus $= 4.87 \times 10^{24}$Kg, Radius of Venus = 6052 km)

$mg = \frac{GMm}{R^2} \rightarrow g = \frac{GM}{R^2}$

$g = \frac{6.673\times10^{-11}\times4.87\times10^{24}}{(6052\times10^3)^2}$

$g = 8.87\ m/s^2$

10 IV. A "swing" ride at a carnival consists of chairs that are swung in a circle by 15.0-m cables attached to a vertical rotating pole, as the drawing shows. Suppose the total mass of a chair and its occupant is m (= 179 kg).



a. Find the radius for the circular motion.

$\sin 60^\circ = \frac{r}{15} \rightarrow r = 15 \sin 60^\circ = 13\,m$

$\boxed{r = 13\,m} = 12.99\,m$

b. Considering the chair and its occupant as the object of interest, show all the forces acting on it, in the diagram, a free-body diagram.

c. Resolve the tension into horizontal and vertical components, in the diagram.

d. Determine the tension in the main cable attached to the chair.

$\downarrow \quad T\cos 60^\circ = mg$

$T = \frac{mg}{\cos 60} = \frac{179 \times 9.8}{\cos 60} = 3508\,N$

e. Find the speed of the chair.

$T\sin 60^\circ = \frac{mv^2}{r} \rightarrow v^2 = \frac{rT\sin 60}{m}$

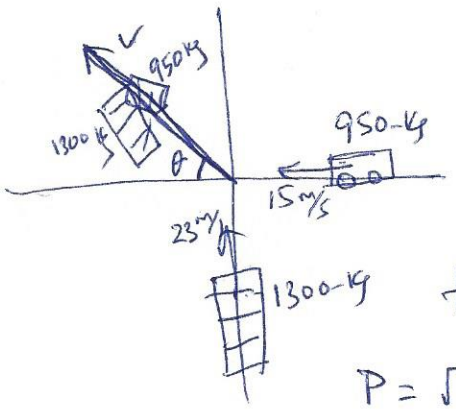
$v = \sqrt{\frac{rT\sin 60}{m}} = \sqrt{\frac{13 \times 3508 \times \sin 60}{179}}$

$v = 14.9\,m/s$

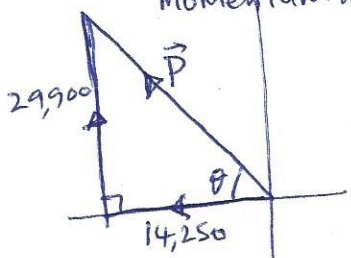
10 V. A car with a mass of 950-kg travelling west with a speed of 15 m/s collides with a minivan, mass = 1300-kg travelling north with a speed of 23 m/s at an intersection. Both vehicles stick together after the collision.

a. Sketch a diagram and show the car & minivan before and after the collision.

b. Find the speed and direction of the wreckage just after the collision.



Momentum diagram



$\tan\theta = \frac{29,900}{14,250} = 2.098 \rightarrow \theta = 64.5^\circ$

$P = \sqrt{29,900^2 + 14,250^2} = 33122\,kg \cdot m/s$

$v = \frac{P}{m} = \frac{33122}{(950+1300)} = 14.7\,m/s$

$\boxed{v = 14.7\,m/s \text{ @ } 64.5^\circ \text{ N of W}}$