ONLINE

PHYS 201 Test #2 Fall 2025 V3 Name: Answer Key Max = 85

2 pts each

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?

$V = V_0 + at$, $6 = 0 + a \times 0.15$

$\frac{6}{0.15} = a = 40\ m/s^2$

$F = ma = 0.70 \times 40 = 28N$

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

C 12. 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 13. 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 14. What is the angle between the centripetal acceleration and centripetal force?

C 15. What is the angle between the acceleration and velocity for an object in uniform circular motion?

Answers for 14-15

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

C 16. 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?

$\mu_s = \frac{100}{500} = 0.2$

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

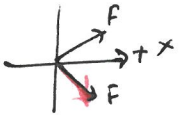
b 17. Which of the following is an example of a perfectly inelastic collision?

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

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

b 19. A force does positive work on a particle that has a displacement pointing in the +X direction. This same force does negative work on a particle that has a displacement pointing in the +Y direction. In what quadrant does the force lie?



a. First quadrant b. Second quadrant c. Third quadrant d. Fourth quadrant

B 20. Estimate the cost of electricity for operating ten (10) 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

$\frac{10 \times 60\ W}{1000} \times 4 \times 20 \times 12 \times 0.09 = \$51.84$

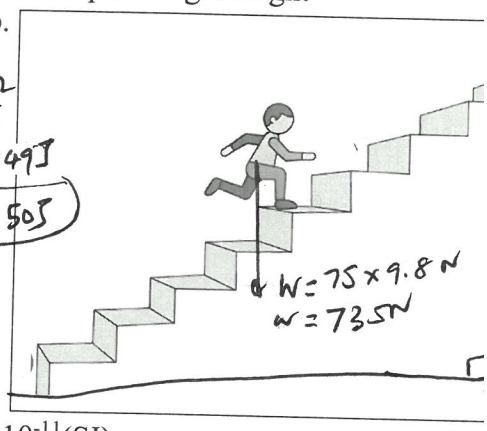
$W = mg = 75 \times 9.8 = 735\,N$

23 B. A person (mass = 75kg) is running up a total of 9 steps with each step having a height of 18 cm in 6.5 seconds and gaining a speed of 4.5 m/s at the top.

7 12 a. How much work is done by the person?

b. What is the power developed by the person to do this?

$9 \times 18\,cm = 162\,cm = 1.62\,m$



a. $W = F \times d = 735 \times 9 \times 0.18 = 1190\,J$ (+ KE $+ \frac{1}{2}mv^2$)

$1190 + \frac{1}{2} \times 75 \times 4.5^2 = 1190 + 759 = 1949\,J$

$\approx 1950\,J$

b. $P = \frac{W}{t} = \frac{1949\,J}{6.5\,s} = 300\,J/s$

$P = 300\,W$

C. Newton's law of gravitation is given: $F = G\frac{Mm}{r^2}$, G = 6.673 x 10^{-11}(SI)

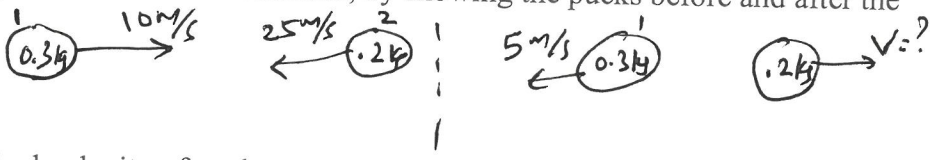
Weight is the force of gravity: $Weight = mg = G\frac{Mm}{r^2}$.

5 Calculate the surface gravity for a planet in another solar system whose mass = 2.9 x 10^{24} Kg and radius = 4500 km.

$$g = \frac{GM}{r^2} = \frac{6.673 \times 10^{-11} \times 2.9 \times 10^{24}}{(4500 \times 10^3)^2} = 9.56\,m/s^2$$

11 D. Two pucks collide on an air hockey table and bounce off each other in opposite directions. Puck 1 has a mass of 0.3 kg and an initial velocity of 10 m/s to the right, and puck 2 has a mass of 0.2 kg and an initial velocity of 25 m/s to the left. After the collision, puck 1 recoils with a velocity of 5 m/s to the left.

3 a. Sketch a diagram and show the collision, by showing the pucks before and after the collision.



b. What is the final velocity of puck 2?

3 Applying conservation of momentum

$0.3 \times 10 - 0.2 \times 25 = -0.3 \times 5 + 0.2V$

$-2 = -1.5 + 0.2V$

$-0.5 = 0.2V \rightarrow V = -\frac{0.5}{0.2} = -2.5$

$V = 2.5\,m/s$, left.

2 c. Name this collision. Inelastic collision

d. Calculate the energy loss during the collision.

3 $\frac{1}{2} \times 0.3 \times 10^2 + \frac{1}{2} \times 0.2 \times 25^2 - \frac{1}{2} \times 0.3 \times 5^2 - \frac{1}{2} \times 0.2 \times 2.5^2$

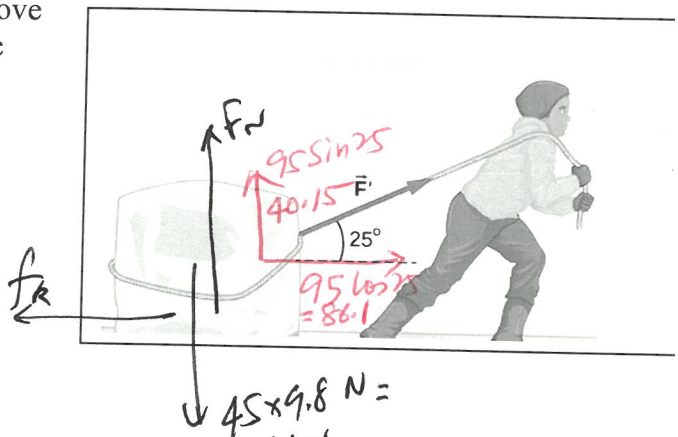
$15 + 62.5 - 3.75 - 0.625 = 73.125$

$77.5 - 4.375 = 73.125$

735

22 E. A 45-kg ice block is pulled along a horizontal surface from rest. The pulling force has a magnitude, F = 95 N, which is applied at 25^0 above the horizontal as shown. The coefficient of kinetic friction between the block and the surface is 0.2.

1. Draw a free-body diagram for the ice block.
2. Resolve the force into horizontal and vertical components, in the diagram.
3. Determine the normal force.
4. Determine the frictional force.
5. Determine the acceleration of the block.
6. How long will it take to move the block 5.5 m.



3. $\Sigma F_y = 0$

$F_N + 40.15 = 441\ N \rightarrow F_N = 441 - 40.15$

$F_N = 400.9\ N$

4. $f_k = \mu_k \cdot F_N = 0.2 \times 400.9 = 80.2\ N$

5. $a = \frac{\Sigma F}{m} = \frac{86.1 - 80.2}{45} = 0.13\ m/s^2$

6. $t = ?$ $\Delta x = 5.5\ m$, $V_0 = 0$, $a = 0.13\ m/s^2$

$\Delta x = V_{0x} t + \frac{1}{2} a_x t^2$

$5.5 = 0 + \frac{1}{2} \times 0.13 \times t^2$

$t^2 = \frac{2 \times 5.5}{0.13} = 84.6$

$t = \sqrt{84.6} = 9.2\ s$