Practice Exam 1

1. The number of significant figures in 0.00150 is:
   A) 2
   B) 3
   C) 4
   D) 5
   E) 6

	1 pt.

2. 1 mile is equivalent to 1609 m so 55 mph (miles per hour) is:
   A) 15 m/s
   B) 25 m/s
   C) 66 m/s
   D) 88 m/s
   E) 1500 m/s

	1 pt.

3. A sphere with a radius of 1.7 cm has a surface area of:
   A) 2.1×10^{-5} m^2
   B) 9.1×10^{-4} m^2
   C) 3.6×10^{-3} m^2
   D) 0.11 m^2
   E) 36 m^2

	1 pt.

4. During a short interval of time the speed v in m/s of an automobile is given by $v = at^2 + bt^3$, where the time t is in seconds. The units of a and b are respectively:
   A) $m \cdot s^2$; $m \cdot s^4$
   B) s^3/m; s^4/m
   C) m/s^2; m/s^3
   D) m/s^3; m/s^4
   E) m/s^4; m/s^5

	1 pt.

5. A car moving with an initial velocity of 25 m/s north has a constant acceleration of 3 m/s^2 south. After 6 seconds its velocity will be:
   A) 7 m/s north
   B) 7 m/s south
   C) 43 m/s north
   D) 20 m/s north
   E) 20 m/s south

	1 pt.

6. A ball is in free fall. Its acceleration is:
   A) downward during both ascent and descent
   B) downward during ascent and upward during descent
   C) upward during ascent and downward during descent
   D) upward during both ascent and descent
   E) downward at all times except at the very top, when it is zero

	1 pt.

7. At a location where $g = 9.80\ \text{m/s}^2$, an object is thrown vertically down with an initial speed of 1.00 m/s. After 5.00 s the object will have traveled:
   A) 125 m
   B) 127.5 m
   C) 245 m
   D) 250 m
   E) 255 m

	1 pt.

8. A boy on the edge of a vertical cliff 20 m high throws a stone horizontally outwards with a speed of 20 m/s. It strikes the ground at what horizontal distance from the foot of the cliff? Use $g = 10\ \text{m/s}^2$
   A) 10 m
   B) 40 m
   C) 50 m
   D) $50\sqrt{5}$ m
   E) none of these

	1 pt.

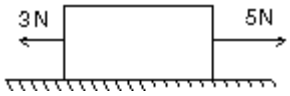
9. Acceleration is always in the direction:
   A) of the displacement
   B) of the initial velocity
   C) of the final velocity
   D) of the net force
   E) opposite to the frictional force

	1 pt.

10. The term "mass" refers to the same physical concept as:
   A) weight
   B) inertia
   C) force
   D) acceleration
   E) volume

	1 pt.

11. The block shown moves with constant velocity on a horizontal surface. Two of the forces on it are shown. A frictional force exerted by the surface is the only other horizontal force on the block. The frictional force is:



A) 0
B) 2 N, leftward
C) 2 N, rightward
D) slightly more than 2 N, leftward
E) slightly less than 2 N, leftward

	1 pt.

12. The "reaction" force does not cancel the "action" force because:
A) the action force is greater than the reaction force
B) they are on different bodies
C) they are in the same direction
D) the reaction force exists only after the action force is removed
E) the reaction force is greater than the action force

	1 pt.

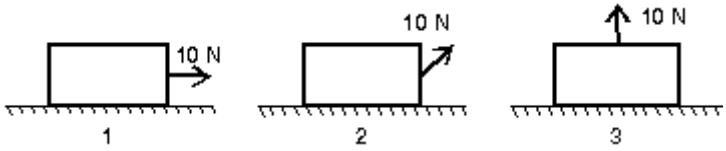
13. A stone is tied to a 0.50-m string and whirled at a constant speed of 4.0 m/s in a vertical circle. Its acceleration at the top of the circle is:
A) 9.8 m/s^2, up
B) 9.8 m/s^2, down
C) 8.0 m/s^2, down
D) 32 m/s^2, up
E) 32 m/s^2, down

	1 pt.

14. An object at the surface of Earth (at a distance R from the center of Earth) weighs 90 N. Its weight at a distance 3R from the center of Earth is:
A) 10 N
B) 30 N
C) 90 N
D) 270 N
E) 810 N

Bonus Question	1 pt.

15. A crate moves 10 m to the right on a horizontal surface as a woman pulls on it with a 10-N force. Rank the situations shown below according to the work done by her force, least to greatest.



A) 1,2,3
B) 2,1,3
C) 2,3,1
D) 1,3,2
E) 3,2,1,

	1 pt.

16. Which of the following bodies has the largest kinetic energy?
A) Mass 3*M* and speed *V*
B) Mass 3*M* and speed 2*V*
C) Mass 2*M* and speed 3*V*
D) Mass *M* and speed 4*V*
E) All four of the above have the same kinetic energy

	1 pt.

17. A 6.0-kg block is released from rest 80 m above the ground. When it has fallen 60 m its kinetic energy is approximately:
A) 4800 J
B) 3500 J
C) 1200 J
D) 120 J
E) 60 J

Bonus Question	1 pt.

SOLVING PROBLEMS

Show all the steps. Give right number of significant digits and write units.

1. Convert 112 m^2 to in^2. Use 1in = 2.54 cm.

	5 pts.

2. A car accelerates from rest to 50 km/h in 22 s on a straight road. Find how far the car traveled during this period.

	5 pts.

3. A man walks 30 km east and then 40 km 25° east of south. Find where the man stands now (how far away he is from where he started and the angle).

	10 pts.

4. A boy throws a piece of food at an angle of θ (30°) with the horizontal. A bird catches the food at a height of 2.8 m after 2.2 s. Use g = 9.80 m/s^2.

Draw clearly a picture showing how you understand this problem. Indicate in this drawing your initial and final states; and positive x and y directions.

3 pts.

Draw a table to list the five quantities in the x and y directions. Record the numerical values for the known quantities.

2.5 pts.

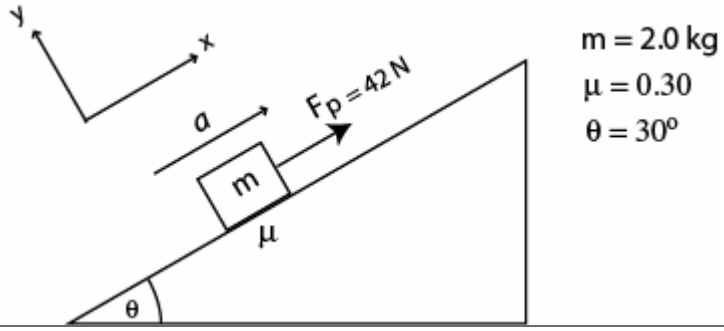
Find the x and y components of the initial velocity (v_{xo} and v_{yo}). And then calculate the initial speed $\left(\sqrt{v_{xo}^2 + v_{yo}^2}\right)$ and the angle θ.

7.5 pts.

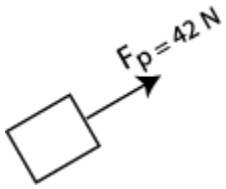
How far away horizontally is the piece of food, when it is caught by the bird?

2. pts.

5. A block is pulled up a rough incline by a force parallel to the incline as shown in the figure. The coefficient of kinetic friction between the block and the incline μ_k = 0.30. The block moves up the incline with an acceleration ***a***. (Use g = 9.80 m/s^2.)



Complete the free body diagram (FBD) for the block (show all the forces acting on the body) in the figure shown below:



3 pts.

Apply Newton's 2nd Law in the *x*-direction (parallel to the incline). In the resulting equation, substitute $F_r = \mu F_N$ for the friction force F_r .Now you will have two unknowns in this equation: a and F_N .

3 pts.

Apply Newton's 2nd Law in the y-direction and calculate the normal force F_N .

2 pts.

Find the acceleration of the block.

	2. pts.

Formula Sheet for major exam 1 – PHYS011

	$v = v_o + a\,t$ $\Delta x = v_o t + \frac{1}{2} a t^2$ $\Delta x = \frac{1}{2}(v_o + v)t$ $v^2 = v_o^2 + 2a\,\Delta x$
	If $\vec{A} = \vec{A}_x + \vec{A}_y$, i.e. $\vec{A} = \langle A_x, A_y \rangle$, then the magnitude of of $\vec{A}$, $A = \sqrt{A_x^2 + A_y^2}$ the angle $\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$
	Newton's 2nd Law : $\sum \vec{F} = m\vec{a}$ $\sum F_x = ma_x$; $\sum F_y = ma_y$
	$F_r = \mu_k F_N$
	$a_r = \frac{v^2}{r}$
	$F_{12} = \frac{G m_1 m_2}{r^2}$
	$W_F = F_{\|} d = F \cos\theta\ d$
	$KE = \frac{1}{2} m v^2$ $PE_{gravity} = mgy$ $PE_{elastic} = \frac{1}{2} k x^2$
	$W_{NC} = \Delta(PE) + \Delta(KE)$ $\Delta(PE) + \Delta(KE) = 0$ if $W_{NC} = 0$ $\Rightarrow$ $PE_1 + KE_1 = PE_2 + KE_2$ conservation of Mechanical Energy