Name: _____ Student I.D.: _____

Practice Midterm Exam 1A

Physics 100, Spring 2007

Test Date: Wednesday, February 14, 2007

Useful Equations and Numbers

Acceleration due to gravity...
on Earth = 10 m/s^2
on Mars = 3.7 m/s^2
on the Moon = 1.6 m/s^2

$$(change\ in\ position)\ =\ \frac{1}{2} \times (acceleration) \times time)^2$$

$$(change\ in\ speed) = (acceleration) \times (time)$$

$$(speed) = \frac{(distance\ traveled)}{(time)}$$

$$(acceleration) = \frac{(change\ in\ velocity)}{(time)}$$

$$(force\ of\ gravity) = (mass) \times (acceleration\ due\ to\ gravity)$$

$$speed\ of\ light\ =\ 299,790,000\ m/s$$

$20\ m/s\ =\ 45\ mph$	$1\ mile/minute\ =\ 60\ mph$
$1\ pound\ of\ force\ =\ 1\ Newton$	$1\ km\ = 0.6\ miles$
$1\ furlong\ =\ 201\ meters$	$1\ hour = 3,600\ seconds$
$1\ minute = 60\ seconds$	$1\ g\ =\ 10\ m/s^2$
$1\ m/s = 3.6\ km/hour$	$1\ Newton\ =\ 1\ \frac{kg\ m}{s^2}$
$1\ m\ =\ 3.2\ feet$	$1\ Joule\ =\ 10,000,000\ ergs$
$\sqrt{200} = 14.14$	$\frac{5}{3} = 1.667$
$\frac{4}{5} = 0.800$	$\frac{1}{6} = 0.167$

DO NOT OPEN EXAM UNTIL INSTRUCTED TO DO SO!
TURN OFF YOUR CELL PHONE!

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Relax! Be sure to write you name and SID on all of the pages. Show your work on all short answer questions! Look on page 1 for a list of handy equations and relations! Keep in mind that this is a long test, so if you're stuck on a problem, move on to the next one!
IF YOU HAVE QUESTIONS ON ANYTHING, RAISE YOUR HAND AND I WILL COME TO YOU!
Good luck!

Section 1. **True/False (2 pts. each)**

Warm up!

_____ An object has higher inertia the faster it moves. This is why it's harder to stop an object that's moving fast than one is moving slow.

_____ Measuring the acceleration of gravity helps prospectors find oil fields and salt mines.

_____ Aristotle invented the concept of inertia.

_____ Galileo agreed with Aristotle that objects fell to the ground with a speed proportional to their weight, but did not believe that it was because they were made of predominantly of the element *earth*, as Aristotle did.

_____ An object is in mechanical equilibrium whenever its instantaneous speed is zero.

_____ An object is in equilibrium if the vector sum of all forces acting on it is zero (i.e. all forces acting on it cancel each other out).

_____ In the simplest sense, a force is a push or a pull.

_____ Whenever an object has a non-zero net force, it is accelerating.

Section 2. **Fill-in-the-Blanks (3 pts. each)**

Note: The size of the blank does not vary with the length of the answer.

1. When any object is in mechanical equilibrium, the sum of all forces acting on that object (F_{net}) is equal to _____.
2. A jet airplane is flying through the air with constant velocity. It's engines are providing a thrust of 9,900 lbs. The only other force acting on the jet is air resistence, which must be providing a force of _____ in a direction _____ the direction of the jet thrust.
3. Most generally, acceleration is defined as the change in _____ per _____. If we are discussing motion along a straight line, then acceleration is equivalent to the change in _____ per _____.
4. If you were to walk by stepping 1 meter in 0.5 seconds, your speed would be _____.
5. Acceleration is _____*(directly/ indirectly)* proportional to mass.

6. The net force acting on a 1 kg ball in free fall is _____.

Section 3. **Multiple Choice (2 pts. each)**
Choose the single best answer unless instructed to do otherwise.
Hint: they're not all (C)!

7. Speed is defined as which of the following?
   (a) $speed = \frac{change\ in\ distance}{change\ in\ time}$
   (b) $speed = \frac{change\ in\ velocity}{change\ in\ time}$
   (c) $speed = \frac{1}{2}gt^2$
   (d) $speed = \frac{change\ in\ distance}{change\ in\ position}$
8. What Aristotelian idea did Galileo discredit in his fabled Leaning Tower of Pisa demonstration?
   (a) The Earth is the center of the Universe
   (b) Natural Motion
   (c) Objects fall at rates proportional to their masses
   (d) Everything is created from differing amounts of the five elements: *fire, water, earth, air, quintessence (aether)*
9. Something is in equilibrium if...
   (a) ... it is moving at a constant speed.
   (b) ... it is moving with a constant acceleration.
   (c) ... only if it is not moving.
   (d) ... it is moving at constant velocity.
10. In which of the following situations would a motorcycle be accelerating (check all that apply)
   (a) Driving around a corner at 20 m/s
   (b) Jumping off of a ramp
   (c) Slowing down to avoid the kitten that jumped into the road
   (d) Speeding up once the kitten crosses the road
   (e) driving straight ahead at 40 m/s
11. Two identical-twin parachutists are skydiving. They weigh exactly the same and are wearing the same clothes, but the parachute of one is larger than the parachute of the other (though the parachutes also weigh the same). Which twin will fall with the greatest speed?
   (a) The one with the smaller parachute.
   (b) The one with the larger parachute.
   (c) They will fall at the same speed.
   (d) There is not enough information.

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Section 4. **Short Answer Questions (5 pts. each)**
Show your work for all calculations. Partial credit is a good thing!

12. If you push on a crate with a force of 75 N and it slides at constant velocity, with how much force is the friction acting on the crate?

13. If you are driving from San Francisco, (A) how would you determine your average speed for the trip?

14. (A) As you stand on a floor, does the floor exert an upward force against your feet? If so, (B) how much force does it exert and (C) why are you not lifted up by this force?

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15. Burl makes careful measurements of a cannonball falling from a 50 m high building on Planet Newton. During the first second of it falling, he observes that the speed of the cannonball goes from 0 m/s to 4 m/s. (A) By how much will the cannonball's speed increase during the third second? (B) How long will it take for the cannonball to hit the Martian soil? (C) How fast will it be traveling when it does hit?

16. (A) What is the weight of a 1 kg brick on the surface of the Earth? (B) What is the weight of a 1 kg brick on the surface of Mars? (C) What is the mass of a 1 kg brick on the surface of the Moon?

17. Can the velocity of an object reverse direction while maintaining a constant acceleration? If so, give an example; if not, provide an explanation.

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18. You hold a small, smooth metal ball for a few seconds before throwing it straight up into the air and catching it again. Fill out the following table: (i) List all of the forces acting on the ball (ii) the direction of the net force, F_{net} (0/UP/DOWN),(iii) the direction of the velocity and (iv) acceleration of the ball (0/UP/DOWN), and (v) state whether it's in equilibrium (YES/NO) during (A)the time it is sitting at rest in your hand for a few seconds, (B) the time which your hand is accelerating the ball, (C) the time after the ball has left your hand and is rising into the air, (D) the time at which the ball is at the top of it's trajectory, (E) the time the ball is falling back down, and (F) the time during which you are catching the ball in your hand.

	All the Forces	Dir. F_{net}	Dir. Veloc.	Dir. Acc.	Equilibrium?
A					
B					
C					
D					
E					
F					

THIS IS THE LAST PAGE OF PRACTICE MIDTERM EXAM 1A.
CONGRATULATIONS!