PHYS 1301: Exam #2 Name:

1. An astronaut is in a spacecraft, orbiting Earth at an altitude h of $520km$ with a speed v of $7.6km/s$. His mass is $79kg$. What is his acceleration? (radius of Earth = $6370km$)
(A) $8.38m/s^2$ **(B)** $8.48m/s^2$ **(C)** $8.58m/s^2$ **(D)** $8.68m/s^2$ **(E)** $8.78m/s^2$

2. A mass m of $100g$ on a frictionless table is attached to a hanging mass M of $1kg$ by a cord through a hole in the table. The mass is moving in a circular path with a radius r of $30cm$ on the table. Find the speed with which m must move for M to stay at rest.
(A) 1.42 m/s **(B)** 2.42 m/s **(C)** 3.42 m/s **(D)** 4.42 m/s **(E)** 5.42 m/s

3. The force on a $10kg$ object increases uniformly from zero to $50N$ in $4.0s$. What is the object's final speed if it started from rest?
(A) 5 m/s **(B)** 10 m/s **(C)** 20 m/s **(D)** 30 m/s **(E)** 40 m/s

For 4 and 5. A $3.5kg$ block is pushed along a horizontal floor by a force $F = 15N$ that makes an angle $\theta = 40°$ with the horizontal. The coefficient of kinetic friction between the block and floor is 0.25.

4. What is the magnitude of the frictional force exerted on the block?
(A) 2.4 N **(B)** $11N$ **(C)** 8.58 N **(D)** 12 N **(E)** 11.5 N

5. What is the acceleration of the block?
(A) 0.11 m/s^2 **(B)** 0.12 m/s^2 **(C)** 0.14 m/s^2 **(D)** 0.18 m/s^2 **(E)** 0.21 m/s^2

6. A $2.0kg$ block is dropped from a height of $40cm$ onto a spring of spring constant $k = 1960N/m$. Find the maximum distance the spring is compressed.
(A) 10 cm **(B)** 15 cm **(C)** 20 cm **(D)** 25 cm **(E)** 30 cm

7. What are the coordinates of the center of mass of the three particles; $3.0kg$ at (0,0), $4.0kg$ at (2,1), and $8kg$ at (1,2)?
(A) (1.0, 1.0) **(B)** (1.1, 1.7) **(C)** (1.5, 1.8) **(D)** (1.1, 1.5) **(E)** (1.1, 1.3)

For 8 to 9: A $3.50g$ bullet is fired horizontally at two blocks resting on a smooth tabletop. The bullet passes through the first block, with mass $1.20kg$, and embeds itself in the second, with mass $1.80kg$. Speeds of 0.630 m/s and 1.40 m/s, respectively, are thereby imparted to the blocks. Neglect the mass removed from the first block by the bullet.

8. What was the bullet's original speed?
(A) $739m/s$ **(B)** $893m/s$ **(C)** $937m/s$ **(D)** $975m/s$ **(E)** $1034m/s$

9. What was the speed of the bullet immediately after it emerges from the first block?

(A) $721 m/s$ **(B)** $843 m/s$ **(C)** $942 m/s$ **(D)** $743 m/s$ **(E)** $834 m/s$

For 10 to 12: A billiard ball moving at a speed of $2.2 m/s$ strikes an identical stationary ball a glancing blow. After the collision, one ball is found to be moving at a speed of $1.1 m/s$ in a direction making a $60°$ with the original line of motion.

10. What is the speed of the other ball?
(A) $1.1 m/s$ **(B)** $0.8 m/s$ **(C)** $1.3 m/s$ **(D)** $1.9 m/s$ **(E)** $2.3 m/s$

11. What is the direction of the movement of the other ball with respect to the initial motion?
(A) $15°$ **(B)** $45°$ **(C)** $60°$ **(D)** $30°$ **(E)** $90°$

12. What kind of collision is this?
(A) elastic **(B)** partially inelastic **(C)** completely inelastic **(D)** more information needed

For 13 to 15: A $4.1 kg$ box of books is lifted vertically from rest a distance of $1.6 m$ by an upward applied force of $60.0 N$.

13. What is the work done by the applied force?
(A) 64 J **(B)** 72 J **(C)** 96 J **(D)** 160 J **(E)** 100 N

14. What is the work done by gravity?
(A) -64 J **(B)** -72 J **(C)** -50 J **(D)** -64 J **(E)** -96 N

15. What is the final speed of the box?
(A) $0.5 m/s$ **(B)** $0.9 m/s$ **(C)** $1.9 m/s$ **(D)** $2.9 m/s$ **(E)** $3.9 m/s$