CODE - AAFGHE - PHY231C, Summer 2006 - PHY 231C – Introductory Physics I – Virtual University 2
EXAM 1
Name:

Your code is: AAFGHE

Put your name here:

Keep this exam **CLOSED** until advised by the instructor.

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60 minute long closed book exam.

Fill out the bubble sheet: last name, first initial, student number, section number and **code**.

A two-sided 8.5 by 11 handwritten help sheet is allowed.

When done, hand in your **test** and your **bubble sheet**.

Thank you and good luck!

Possibly useful constants:

- g = 9.81 m/s^2
- G = 6.67$\times 10^{-11}$ Nm^2/kg^2
- σ = 5.67 $\times$ 10^{-8} W/(m^{2}K^4)
- R= 0.0821 L*atm/(mol*K) = 8.31 J/(mol*K)

Possibly useful Moments of Inertia:

- Solid homogeneous sphere: $I_{CM} = (2/5)MR^2$
- Thin spherical shell: $I_{CM} = (2/3)MR^2$
- Thin uniform rod, axis perpendicular to length: $I_{CM} = (1/12)ML^2$
- Solid homogeneous cylinder, axis through center of mass and parallel to length: $I_{CM} = (1/2)MR^2$

Useful information for Geometry:

- Volume of a sphere: $V = (4/3)\pi r^3$
- Volume of a cylinder: $V = \pi r^2 h$

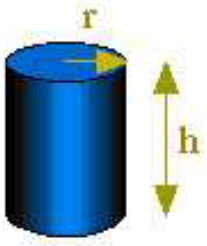
9 pt From **dimensional analysis considerations alone**, mark these formulas as either 'valid' or 'invalid'. Assume that x has dimensions of distance, v has dimensions of velocity, t has dimensions of time, g has dimensions of acceleration and m has dimensions of mass.

▷ $vt/x = 42$
1. **A**◯ valid **B**◯ invalid

▷ $mv = 6mgt(1 + 2gt^2/x)$
2. **A**◯ valid **B**◯ invalid

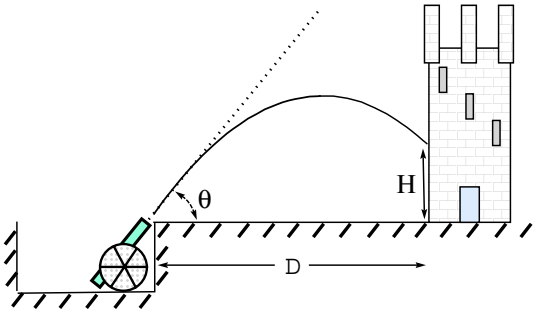
▷ $m(x + vt)(gt + 1) = mgt^2/2$
3. **A**◯ valid **B**◯ invalid

9 pt A right cylinder has a radius r of 14.4 mm and a height h of 34.7 mm. What is the volume of the cylinder in cm^3?



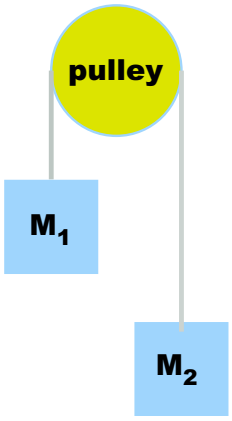
4.
A◯ 2.26×10^1 **B**◯ 2.26×10^2 **C**◯ 2.26×10^3
D◯ 7.20×10^3 **E**◯ 2.26×10^4 **F**◯ 2.26×10^5
G◯ 2.26×10^6 **H**◯ 2.26×10^7

8 pt Assume you are a medieval knight attacking a castle with a canon. The ball leaves the cannon with a speed of 32.9 m/s.



The barrel's angle with respect to the ground is 47.5 deg, and you make a perfect hit on the tyrant's chamber which is at the same level as the cannon's muzzle (H=0). What is the time of flight of the cannon ball?
(in s*)*

5.
A◯ 1.58 **B**◯ 2.10 **C**◯ 2.80
D◯ 3.72 **E**◯ 4.95 **F**◯ 6.58
G◯ 8.75 **H**◯ 1.16×10^1



Consider an Atwood machine with m_2 =4.9 kg. The acceleration of m_2 is measured to be 5.05 m/s^2 upward.
DATA: g=9.81 m/s^2

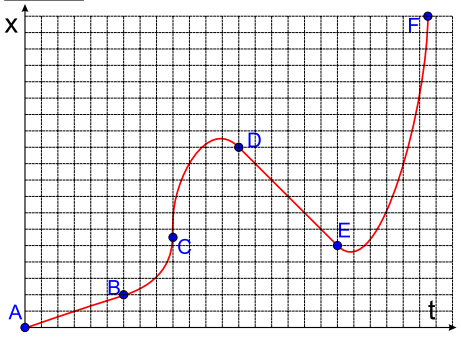
8 pt What is the tension in the rope? *(in* N*)*

6.
A◯ 24.3 **B**◯ 28.4 **C**◯ 33.2 **D**◯ 38.9
E◯ 45.5 **F**◯ 53.2 **G**◯ 62.2 **H**◯ 72.8

8 pt If the blocks are initially at rest, how far will m_2 have risen by 2.1 seconds? *(in* m*)*

7.
A◯ 11.14 **B**◯ 13.92 **C**◯ 17.40 **D**◯ 21.75
E◯ 27.19 **F**◯ 33.98 **G**◯ 42.48 **H**◯ 53.10

12 pt Consider the plot of position vs. time below.



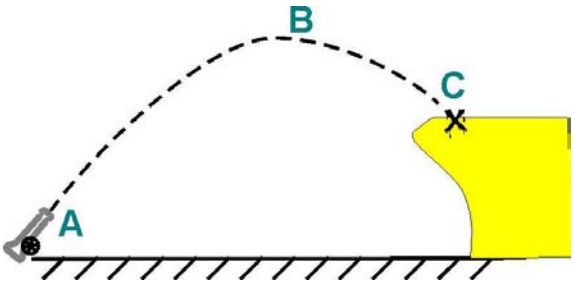
▷ The acceleration is negative in region ____.
8. **A**◯ AB **B**◯ CD **C**◯ DE **D**◯ EF

▷ The acceleration is positive in region ____.
9. **A**◯ AB **B**◯ CD **C**◯ DE **D**◯ EF

▷ The velocity is uniform and positive in region ____.
10. **A**◯ AB **B**◯ CD **C**◯ DE **D**◯ EF

▷ The velocity is uniform and negative in region ____.
11. **A**◯ AB **B**◯ CD **C**◯ DE **D**◯ EF

12 pt Consider a projectile which strikes a target as shown below. Ignore all forces except gravity. Point A refers to a point just beyond the muzzle of the cannon, B refers to the highest point in the trajectory and C refers to a point just before landing on the cliff.



▷ The horizontal component of the velocity at A is ____ than the horizontal component of the velocity at C.

12. **A**◯ greater than **B**◯ less than **C**◯ equal to

▷ The acceleration at B is ____ the acceleration at C.

13. **A**◯ greater than **B**◯ less than **C**◯ equal to

▷ The vertical component of the velocity at B is ____ zero.

14. **A**◯ greater than **B**◯ less than **C**◯ equal to

▷ The magnitude of the vertical component of the velocity at A is ____ the magnitude of the vertical component of the velocity at C

15. **A**◯ greater than **B**◯ less than **C**◯ equal to

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9 pt A fisherman catches a 20 lb trout (mass=9.072 kg), and takes the trout in an elevator to the 78th floor to impress his girl friend, who is the CEO of a large accounting firm. The fish is hanging on a scale, which reads 20 lb.s while the fisherman is stationary. Later, he returns via the elevator to the ground floor with the fish still hanging from the scale.

▷ In the instance just before the elevator comes to a stop on the 78th floor, the reading on the scale will be _____ 20 lbs.

16. **A**◯ greater than **B**◯ less than **C**◯ equal to

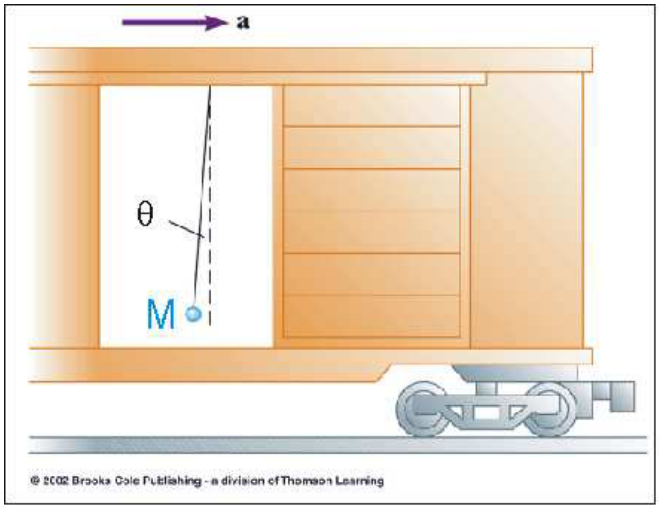
▷ In the instant just before the elevator comes to a stop on the 78th floor, the mass of the fish will be _____ 9.072 kg.

17. **A**◯ greater than **B**◯ less than **C**◯ equal to

▷ On the way back down, while descending at constant velocity, the reading on the scale will be _____ 20 lbs.

18. **A**◯ greater than **B**◯ less than **C**◯ equal to

A 7.8 kg object hangs at one end of a rope that is attached to a support on a railroad car. When the car accelerates to the right, the rope makes an angle of 9.4 degrees with the vertical, as shown in the figure below.



8 pt What is the tension in the rope in Newtons?

19. **A**◯ 68.6 **B**◯ 77.6 **C**◯ 87.6 **D**◯ 99.0 **E**◯ 111.9 **F**◯ 126.5 **G**◯ 142.9 **H**◯ 161.5

8 pt What is the acceleration of the railroad car in m/s^2?

20. **A**◯ 0.39 **B**◯ 0.52 **C**◯ 0.69 **D**◯ 0.92 **E**◯ 1.22 **F**◯ 1.62 **G**◯ 2.16 **H**◯ 2.87

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9 pt An object is thrown directly downward from the top of a very tall building. The speed of the object just as it is released is 25.9 m/s. After being thrown, the object falls freely due to gravity. Neglect air resistance and calculate the distance, in meters which the object covers between times t1 = 2.86 s and t2 = 6 s after it is thrown.

21. **A**◯ 116 **B**◯ 136 **C**◯ 159 **D**◯ 186 **E**◯ 218 **F**◯ 255 **G**◯ 298 **H**◯ 349
