nagytibo@msu

Nagy,

Tibor

Please, sit in row L.

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

50 minute long closed book exam.

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

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

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

Thank you and good luck!

Posssibly useful constant:

- g = 9.81 m/s^2

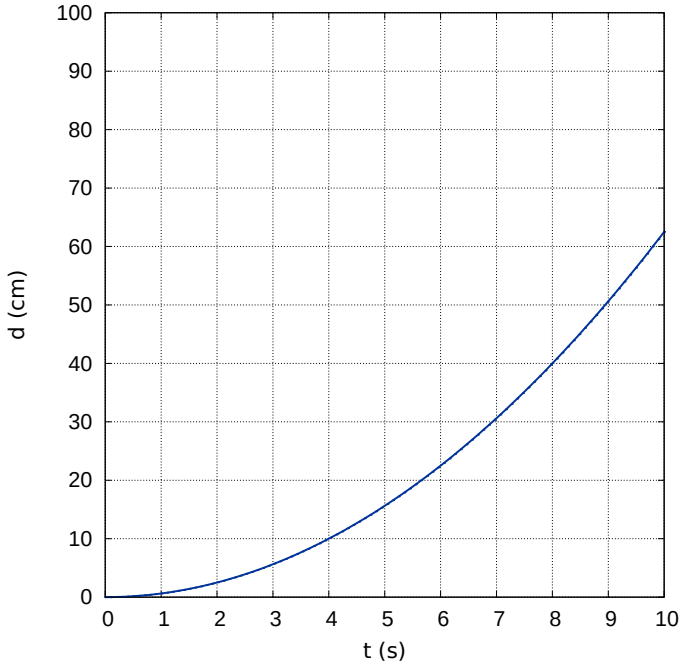
1 pt Are you sitting in the seat assigned?

1.**A**◯ Yes, I am.

[4 pt] An apple, a brick and a hammer are all dropped from the second floor of a building at the same time. Which object(s) will hit the ground first?

2.**A**◯ The hammer will hit first.
B◯ The brick and the hammer will hit the ground first in a tie.
C◯ The apple will hit first.
D◯ The hammer and the apple will hit the ground first in a tie.
E◯ They all hit the ground at the same time.
F◯ Without knowing the masses of the objects, we cannot tell which one hits the ground first.
G◯ The apple and the brick will hit the ground first in a tie.
H◯ The brick will hit first.

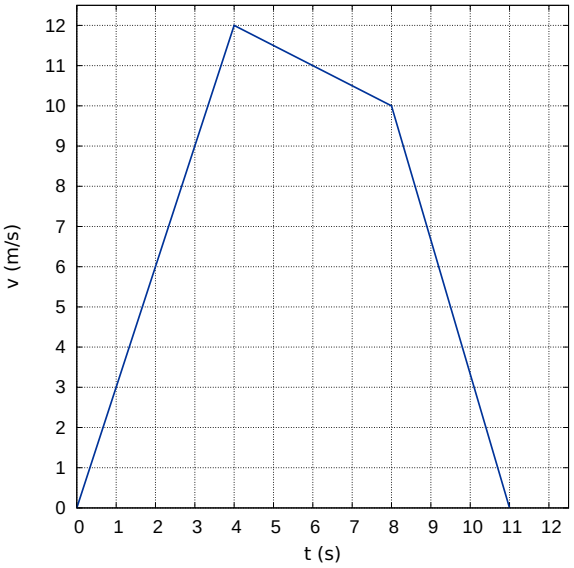
A small marble is rolling down on an incline. The distance travelled by the marble as the function of time is shown in the figure.



[4 pt] What is the acceleration of the marble? Please, note that the curve goes through at least one grid intersection point.
(in `cm/s^2`*)*

3. **A**◯ 0.283 **B**◯ 0.410 **C**◯ 0.595 **D**◯ 0.862
E◯ 1.25 **F**◯ 1.81 **G**◯ 2.63 **H**◯ 3.81

A car is waiting at an intersection. When the traffic light turns green, the car starts moving. After some time the car comes to rest at another traffic light. The figure below shows the velocity of the car as a function of time.



One can clearly identify three different stages of this motion.

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3 pt What is the acceleration of the car during the second stage of the motion?
(in `m/s^2`*)*

4. **A**◯ -0.667 **B**◯ -0.500 **C**◯ -0.400 **D**◯ -0.333
E◯ 0 **F**◯ 0.333 **G**◯ 0.500 **H**◯ 0.667

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3 pt What is the total distance travelled by the car between the two traffic lights?
(in `m`*)*

5. **A**◯ 66.4 **B**◯ 83.0 **C**◯ 104 **D**◯ 130.
E◯ 162 **F**◯ 203 **G**◯ 253 **H**◯ 317

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3 pt An artillery shell is launched on a flat, horizontal field at an angle of $\alpha = 41.4°$ with respect to the horizontal and with an initial speed of $v_0 = 261$ m/s. What is the horizontal velocity of the shell after 20.95 s of flight? (Neglect air friction. Use the coordinate system where the x-axis is horizontal and points to the right; and the y-axis is vertical and points up.)
(in `m/s`*)*

6. **A**◯ 2.66×10^1 **B**◯ 3.54×10^1 **C**◯ 4.70×10^1
D◯ 6.26×10^1 **E**◯ 8.32×10^1 **F**◯ 1.11×10^2
G◯ 1.47×10^2 **H**◯ 1.96×10^2

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3 pt What is the vertical velocity of the shell at this moment?
(in `m/s`*)*

7. **A**◯ -6.59×10^1 **B**◯ -4.94×10^1 **C**◯ -3.30×10^1
D◯ -1.65×10^1 **E**◯ 1.65×10^1 **F**◯ 6.59×10^1
G◯ 8.24×10^1 **H**◯ 9.89×10^1

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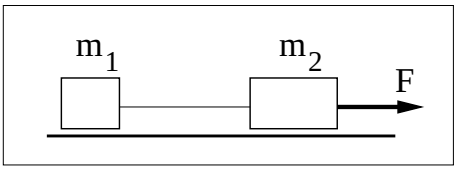
4 pt The International Space Station (ISS) flies on a circular orbit with a speed of 7.71 km/s at a height of 330.0 km above the surface of the Earth. What is the centripetal acceleration of the station? (The radius of the Earth is 6371 km.)
(in `m/s^2`*)*

8. **A**◯ 2.33 **B**◯ 2.91 **C**◯ 3.63
D◯ 4.54 **E**◯ 5.68 **F**◯ 7.10
G◯ 8.87 **H**◯ 1.11×10^1

Two masses, $m_1 = 2.20$ kg and $m_2 = 6.80$ kg are on a horizontal frictionless surface and they are connected together with a rope as shown in the figure.



4 pt The rope connecting the two masses will snap, if the tension in it exceeds 55.0 N. What is the maximum value of the force **F** which can be applied on the right hand side?
(in `N`*)*

9. **A**◯ 4.07×10^1 **B**◯ 5.41×10^1 **C**◯ 7.19×10^1
D◯ 9.56×10^1 **E**◯ 1.27×10^2 **F**◯ 1.69×10^2
G◯ 2.25×10^2 **H**◯ 2.99×10^2

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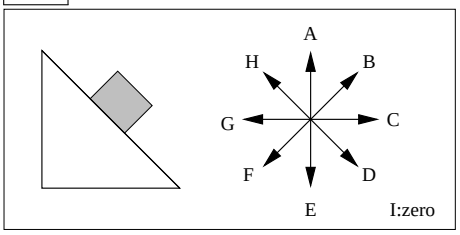
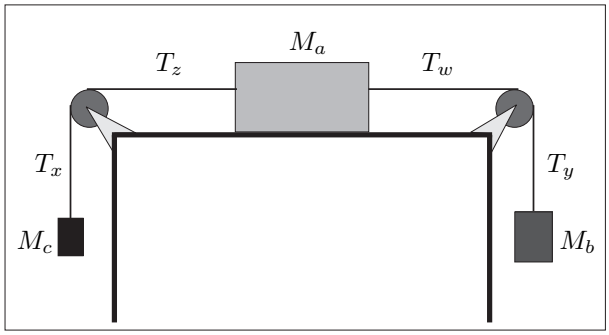
3 pt A block is at rest on a frictional incline. (See figure.)



Which vector best represents the direction of the force exerted by the surface on the block?

10.**A**◯ A
B◯ B
C◯ C
D◯ D
E◯ E
F◯ F
G◯ G
H◯ H
I◯ I: the force is zero.

In the figure below, assume that the pulleys are massless and frictionless.



12 pt The masses of the blocks are M_a=5.50 kg, M_b=3.00 kg, M_c=1.50 kg, and there is friction between the horizontal plane and M_a, ($\mu_k \neq 0$). M_a is observed to travel at a constant velocity.

▷ T_w is .... T_y.
11. **A**◯ True **B**◯ False **C**◯ Greater than **D**◯ Less than **E**◯ Equal to

▷ T_w is .... T_x.
12. **A**◯ True **B**◯ False **C**◯ Greater than **D**◯ Less than **E**◯ Equal to

▷ M_a is moving to the left.
13. **A**◯ True **B**◯ False **C**◯ Greater than **D**◯ Less than **E**◯ Equal to

▷ The magnitude of the total force on M_a is .... 0.
14. **A**◯ True **B**◯ False **C**◯ Greater than **D**◯ Less than **E**◯ Equal to

▷ M_c accelerates upward.
15. **A**◯ True **B**◯ False **C**◯ Greater than **D**◯ Less than **E**◯ Equal to

▷ T_x is .... M_c*g.
16. **A**◯ True **B**◯ False **C**◯ Greater than **D**◯ Less than **E**◯ Equal to

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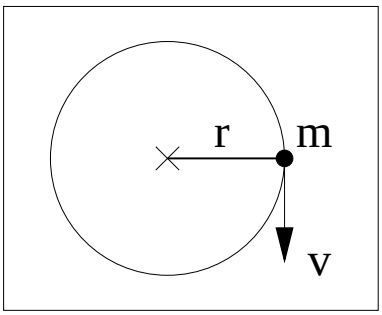
A small object with a mass of m = 961 g is whirled at the end of a rope in a vertical circle with a radius of r = 151 cm.



3 pt When it is at the location shown, (mid-height), its speed is v = 5.82 m/s. Determine the tension in the rope.
(in `N`*)*

17. **A**◯ 3.36 **B**◯ 4.88 **C**◯ 7.07
D◯ 1.03×10^1 **E**◯ 1.49×10^1 **F**◯ 2.16×10^1
G◯ 3.13×10^1 **H**◯ 4.53×10^1

3 pt Calculate the magnitude of the total force acting on the mass at that location.
(in `N`*)*

18. **A**◯ 3.67 **B**◯ 5.32 **C**◯ 7.72
D◯ 1.12×10^1 **E**◯ 1.62×10^1 **F**◯ 2.35×10^1
G◯ 3.41×10^1 **H**◯ 4.95×10^1