1 pt A drunk driver strikes a parked car. During the collision the cars become entangled and skip to a stop together. Each car has a total mass of 910 kg. If the cars slide 16.5 m before coming to rest, how fast was the drunk driver going? The coefficient of sliding friction between the tires and the road is 0.35. *(in* `m/s`*)*

1.**A**◯ 2.892 **B**◯ 3.846 **C**◯ 5.116
D◯ 6.804 **E**◯ 9.049 **F**◯ 12.035
G◯ 16.007 **H**◯ 21.289

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1 pt A baseball has a mass of about 0.17 kg, and it is pitched towards home plate at a speed of about 37 m/s. If the bat exerts an average force of 7300 N for 1.9 ms, what is the final speed of the ball in m/s? *(in* `m/s`*)*

2.**A**◯ 25.21 **B**◯ 33.52 **C**◯ 44.59
D◯ 59.30 **E**◯ 78.87 **F**◯ 104.90
G◯ 139.52 **H**◯ 185.56

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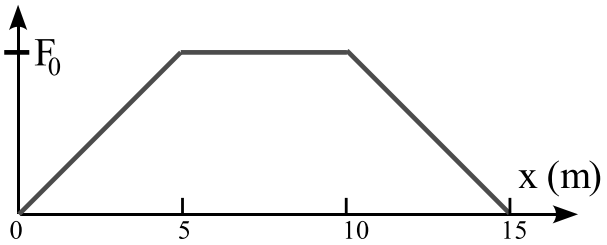
1 pt



Consider the graph of force, F, vs. position, x, shown above. The hashmark on the vertical axis denotes a value F_0=30 N. Find the velocity of a 7.7-kg object as it moves from x = 0.0 to x = 15.0 m after starting at rest. *(in* `m/s`*)*

3.**A**◯ 2.82 **B**◯ 3.75 **C**◯ 4.99 **D**◯ 6.64
E◯ 8.83 **F**◯ 11.74 **G**◯ 15.61 **H**◯ 20.77

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1 pt The launching mechanism of a toy gun consists of a spring whose spring constant is 6942 N/m. The spring is compressed a distance 3.1 cm before launching. What is the maximum height to which the gun can launch a 20-g projectile? *(in* `m`*)*

4.**A**◯ 13.31 **B**◯ 15.04 **C**◯ 17.00 **D**◯ 19.21
E◯ 21.71 **F**◯ 24.53 **G**◯ 27.72 **H**◯ 31.32

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1 pt Some asteroid named "Briggie" has been discovered revolving around the Sun on a circular orbit with a period of 2.70 years. What is the radius of Briggie's orbit? DATA: The radius of Earth's orbit is 1.50E+11 m. *(in* `m`*)*

5.**A**◯ 3.95×10^{10} **B**◯ 5.25×10^{10} **C**◯ 6.99×10^{10}
D◯ 9.30×10^{10} **E**◯ 1.24×10^{11} **F**◯ 1.64×10^{11}
G◯ 2.19×10^{11} **H**◯ 2.91×10^{11}

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1 pt A train has a speed of V = 90.1 km/h. If the acceleration experienced by the passengers is to be less than 0.45 g, find the smallest radius of curvature R acceptable for the track. DATA: g = 9.81 m/s^2 *(in* `m`*)*

6.**A**◯ 103.7 **B**◯ 121.3 **C**◯ 141.9 **D**◯ 166.0
E◯ 194.2 **F**◯ 227.3 **G**◯ 265.9 **H**◯ 311.1

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1 pt The diameter of the main rotor of a single-engine helicopter is 13.8 m. The rotational speed is 430 rev/min. What is the speed of the tip of the large rotor? Give answer as a fraction of the speed of sound, v_{sound} = 343 m/s.

7.**A**◯ 0.12 **B**◯ 0.16 **C**◯ 0.22 **D**◯ 0.29
E◯ 0.39 **F**◯ 0.51 **G**◯ 0.68 **H**◯ 0.91

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1 pt Consider twins named Bert and Ernie who are visiting a planet named Izzone. Bert is standing at the top of the highest mountain on Izzone, a distance R from the center of the planet. Ernie flies by in a space ship which is in a stable circular orbit at the same altitude R.

▷ If Ernie were to step on a bathroom scale in his space ship, his weight would register as zero.
8. **A**◯ True **B**◯ False

▷ Ernie and Bert experience the same acceleration.
9. **A**◯ True **B**◯ False

▷ Ernie and Bert feel the same gravitational force but Bert also feels an additional force from the ground.
10. **A**◯ True **B**◯ False

▷ If Big Bird were to fly in a circular orbit of radius 3R, Big Bird would experience one third of the gravitational force experienced by Ernie.
11. **A**◯ True **B**◯ False

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1 pt A vicious young gorilla named Donkey Kong swings from a vine and at the bottom of his swing, grabs a football player who he has mistaken for the love of his life. As luck would have it, both Donkey Kong and the linebacker have the same mass. If Donkey Kong starts his swing at rest from an angle of 57 degrees from the vertical, to what final angle do Donkey Kong and his sweetheart ultimately reach on their upward swing? (give answer in degrees)

12.**A**◯ 12.59 **B**◯ 14.73 **C**◯ 17.24 **D**◯ 20.17
E◯ 23.59 **F**◯ 27.61 **G**◯ 32.30 **H**◯ 37.79

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1 pt A rock is dropped from outer space (initial velocity=0) at a distance of $2.1R_{earth}$ from the Earth's center. What speed will it have when it reaches the surface of the planet. (Ignore the air resistance felt during the last few miles of the approach to the planet) $R_{earth} = 6.38\times10^6$ m, $M_{earth} = 5.98\times10^{24}$ kg. *(in* `m/s`*)*

13.**A**◯ 871 **B**◯ 1263 **C**◯ 1831 **D**◯ 2655
E◯ 3849 **F**◯ 5581 **G**◯ 8093 **H**◯ 11735

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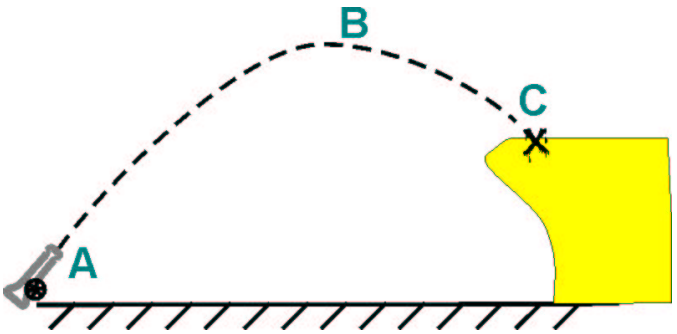
1 pt Consider a projectile which strikes a target as shown below. Ignore all forces except gravity. Point A refers to a point just beyond the muzzle of the cannon, B refers to the highest point in the trajectory and C refers to a point just before landing on the cliff.



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

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

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

15. **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

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

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

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