**Forces Review**

1. Two groups of five men each are engaged in a tug-of-war, each man pulling with a force of 900 N. If the rope does not move, the tension in it is

A) 18 kN B) 9.0 kN C) 44 kN D) 4.5 kN E) 0.46 kN

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| Explain why you choose your answer. |

2. Complete the following statement: The term *net force* most accurately describes

A) the mass of an object

B) the inertia of an object.

C) the quantity that causes displacement.

D) the quantity that keeps an object moving.

E) the quantity that changes the velocity of an object.

3. Which one of the following terms is used to indicate the natural tendency of an object to remain at rest or in motion at a constant speed along a straight line?

A) velocity B) force C) acceleration D) equilibrium E) inertia

4. When the net force that acts on a hockey puck is 10 N, the puck accelerates at a rate of 50 m/s2. Determine the mass of the puck.

A) 0.2 kg B) 1.0 kg C) 5 kg D) 10 kg E) 50 kg

5. A rock is thrown straight up from the earth's surface. Which one of the following statements concerning the *net force* acting on the rock at the top of its path is true?

A) It is equal to the weight of the rock.

B) It is instantaneously equal to zero newtons.

C) Its direction changes from up to down.

D) It is greater than the weight of the rock.

E) It is less than the weight of the rock, but greater than zero newtons.

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| Explain why you choose your answer. |

6. A force accelerates a body of mass *M.* The same force applied to a second body produces three times the acceleration. What is the mass of the second body?

A)*M*  B) 3*M*  C) *M*/3 D) 9*M*  E) *M*/9

Use the following to answer question 7:

A 2.0-kg object moves in a straight line on a horizontal frictionless surface. The graph shows the velocity of the object as a function of time. The various equal time intervals are labeled using Roman numerals: I, II, III, IV, and V. The net force on the object always acts along the line of motion of the object.

7. Which section(s) of the graph correspond to a condition of *zero net force*?

A) V only B) III only C) II and IV D) II, III, and IV E) I, III, and V

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| Explain why you choose your answer. |

8. A body moves with constant speed in a straight line. Which of the following statements must be true?

A) No force acts on the body.

B) A single constant force acts on the body in the direction of motion.

C) A single constant force acts on the body in the direction opposite to the motion.

D) A net force of zero acts on the body.

E) A constant net force acts on the body in the direction of motion.

9. The weight of an object is

A) the same as the mass of the object.

B) the quantity of matter in the object.

C) the mass of the object multiplied by the acceleration due to gravity at sea level, regardless of where the object is located.

D) the result of the gravitational force acting on the object.

E) the reading on a spring scale attached to the object.

10. The acceleration due to gravity on the moon is only about 1/6 of that on earth. An astronaut whose weight on earth is 600 N travels to the lunar surface. His mass as measured on the moon is

A) 600 kg B) 100 kg C) 61.2 kg D) 10.0 kg E) 360 kg

11. A boy holds a bird in his hand. The reaction force to the weight of the bird is the force of the

A) earth on the bird.

B) bird on the earth.

C) hand on the bird.

D) bird on the hand.

E) earth on the hand.

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| Explain why you choose your answer. |

12. A body of weight *w* is in free fall near the surface of the earth. What force does the body exert on the earth?

A)*w*  B) greater than *w*  C) less than *w*  D) 9.81*w*  E) zero

13. A cricket batsman hits a ball with a bat. If the force with which the bat hits the ball is considered the action force, what is the reaction force?

A) the force the bat exerts on the batsman's hands

B) the force on the ball exerted by the hand of the person who catches it

C) the force the ball exerts on the bat

D) the force the bowler exerts on the ball in throwing it

E) friction as the ball rolls to a stop

14. A block of wood is pulled by a horizontal string across a rough surface at a constant velocity by a force of 20 N. The coefficient of kinetic friction between the surfaces is 0.3. The force of friction is

A) impossible to determine without knowing the mass of the block.

B) impossible to determine without knowing the speed of the block.

C) 0.3 N

D) 6 N

E) 20 N

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| Explain why you choose your answer. |

15.

 

A block of mass *m* is at rest on an inclined plane that makes an angle of 30º with the horizontal, as shown in the figure. Which of the following statements about the force of static friction is true?

a. Is the normal force acting on the block greater than, less than, or equal to its weight Justify your answer.

b. Assuming the block is at rest on the incline, what kind of friction acts on the block, static or kinetic? What would increasing the ramp angle do to the force?

m2

*θ*

m1

16. The system above is frictionless and at rest. Is mass 1 greater than, less than, or equal to mass 2? Justify your answer.

(from the 2017 AP Exam) (12 points, suggested time 25 minutes)

A student wants to determine the coefficient of static friction between a long, flat wood board and a small wood block.

* 1. Describe an experiment for determining the coefficient of static friction between the wood board and the wood block. Assume equipment usually found in a school physics laboratory is available.
		1. Draw a diagram of the experimental setup of the board and block. In your diagram, indicate each quantity that would be measured and draw or state what equipment would be used to measure each quantity.
		2. Describe the overall procedure to be used, including any steps necessary to reduce experimental uncertainty. Give enough detail so that another student could replicate the experiment.
	2. Derive an equation for the coefficient of static friction in terms of quantities measured in the procedure from part (a).

A physics class consisting of six lab groups wants to test the hypothesis that the coefficient of static friction between the board and the block equals the coefficient of kinetic friction between the board and the block. Each group determines the coefficients of kinetic and static friction between the board and the block. The groups’ results are shown below, with the class averages indicated in the bottom row.

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| --- | --- | --- |
| Lab Group Number | Coefficient of Kinetic Friction | Coefficient of Static Friction |
| 1 | 0.45 | 0.54 |
| 2 | 0.46 | 0.52 |
| 3 | 0.42 | 0.56 |
| 4 | 0.43 | 0.55 |
| 5 | 0.74 | 0.23 |
| 6 | 0.44 | 0.54 |
| Average | 0.49 | 0.49 |

* 1. Based on these data, what conclusion should the students make about the hypothesis that the coefficients of static and kinetic friction are equal?

 The static and kinetic coefficients are equal.

 The static and kinetic coefficients are not equal.

Briefly justify your reasoning.

* 1. A metal disk is glued to the top of the wood block. The mass of the block-disk system is twice the mass of the original block. Does the coefficient of static friction between the bottom of the block and the board increase, decrease, or remain the same when the disk is added to the block?

 Increase Decrease Remain the same

Briefly state your reasoning.