MOTION & FORCE: DYNAMICS

(136)

NAME_____ (Ch. 4) TEST #4 October 29, 2015

Choose ONE of the following 2 questions and answer in complete sentences.

1. Why does a passenger in a car seem to be thrown into the door when the driver makes a sharp left turn?

Pass has INERTIA ⇒ tendency to remain in motion.

(2)

1. Sometimes passengers struck from behind in a car accident experience an injury known as "whiplash". The passengers say their "head is thrown backwards" upon being struck from the rear. Explain how headrests serve to reduce this effect.

Head actually stays @ rest, while body is forced out from under it.

OR (2)

2. If the acceleration of a body is zero, does that mean there are no forces acting on it? Explain.

$F_{net} = \Sigma F$. There MAY be forces but they MUST be balanced.

(2)

Matching:

C	3. Newton's 1st Law	a. For every force acting on an object, an equal but opposite force will delivered in return.
(3) B	4. Newton's 2nd Law	b. The acceleration of an object is directly proportional to the force applied and inversely related to its mass.
A	5. Newton's 3rd Law	c. An object continues in its present state of motion unless acted upon by an unbalanced force.

6. When you push your smaller friend on roller skates, *you* also roll backward, but not as rapidly. Explain why this happens on the basis of **Newton's 3rd and 2nd laws** citing **each** in your explanation.

3RD 2ND
Act-React ⇒ forces are = BUT F=ma, so larger mass ⇒ smaller acc.

(3)

Correct writing of 2nd & 3rd.

D 7. In the absence of an external force, a moving object will (a) stop immediately. (b) slowly slow down and then stop. (c) go faster and faster. (d) move with constant speed.

(2)

B 8. When a force **F** acts on a 1.0 kg mass, acceleration **"a"** results. What acceleration, in terms of **"a"**, results when a force of **2F** acts on a 2 kg mass? (a) a/2 (b) a (c) 2a (d) none of the above.

(12)

C 9. Which of the following best expresses the meaning of the word **"force"?**
(a) potential energy (b) ability to do work (c) push or pull (d) pressure (e) motion

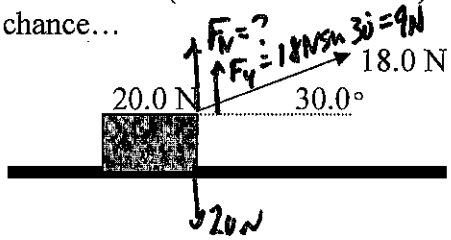
D 10. A rocket moves through empty space in a straight line with constant speed. It is far from the gravitational effects of a planet or star. Under these conditions, the force that must be supplied to the rocket in order to sustain its motion is
(3) (a) equal to its weight. (b) equal to its mass. (c) dependent on how fast it is moving.
(d) zero.

D 11. If you exert a force F on an object, the force which the object exerts on you (a) will depend on whether or not the object is moving. (b) will depend on whether or not you are moving. (c) will depend on the relative masses of you and the object. (d) will be F in all cases.

PROBLEMS: Be sure to show all work including equation,...and units at the start and end!

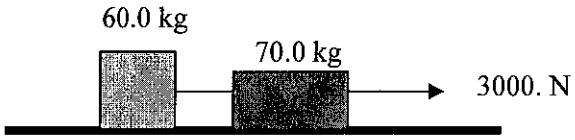
12. A 20.0 N block is being pushed across a horizontal frictionless table by an 18.0 N force at an angle of 30.0° with the horizontal. Find the force the surface exerts on the block (a.k.a. normal force). If you draw a FBD, you'll have a better chance...

(2)



y
$F_{net} = ma$ F_y
$0 = F_N + F_y - 20N$
$F_N = 20N - 9N = \underline{11N}$

13. Two crates, 60.0 kg and 70.0 kg, are attached by a cord and are pulled to the right with a force of 3000 N on a frictionless surface.



a) the acceleration of both blocks,

(2) $a = \frac{F_{net}}{m} = \frac{3000N}{130kg} = \underline{23.\frac{m}{s^2}}$

b) the force on the cord between the crates.

(2) $\longrightarrow F_{cord}$ $F_{cord} = m.a$

$F_{cord} = 60kg(23\frac{m}{s^2}) = \underline{1400N}$

(19)

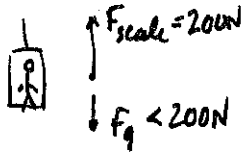
A 14. A roller coaster does a loop-the loop. When it is upside down at the very top, which of the following is true?

(a) The normal force and weight are in the same direction.
(b) The normal force points upward while the weight points downward.
(c) The normal force points downward while the weight points upward.
(d) The weight becomes zero.

(2)

D 15. You stand on a bathroom scale in an elevator accelerating upwards and it reads 200 Newtons. Which of the following is true?

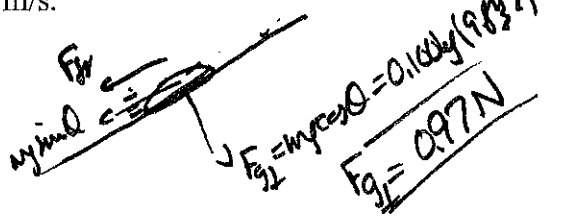
(a) You weigh 200 Newtons.
(b) The scale exerts a 200 N force on you.
(c) The acceleration of the elevator is 20.4 m/s^2.
(d) None of the above are correct.



16. A bar of soap (m = 0.100 kg) slides up an incline of 10.0 ° (coefficient of kinetic friction = 0.25) with an initial velocity of 8.0 m/s.
Determine:

a) the perpendicular component of the soap's weight.

(2)



b) the frictional force on the soap.

(2) $F_{fr} = \mu F_N = 0.25(0.97N) = 0.24N$

+1 for calc $F_{g\perp}$

c) net force on the soap.

(3) $F_{net} = \Sigma F = mg\sin\theta + F_{fr} = 0.17N + 0.24N = -0.41N$

+1 for correct add of forces
+1 for $F_{net} = \Sigma F$

d) acceleration of the soap.

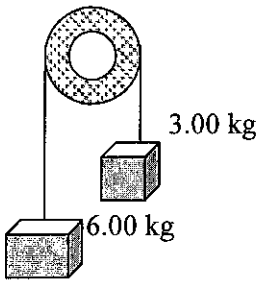
(2) $a = \frac{F_{net}}{m} = \frac{-4.14N}{0.100kg} = -4.1\frac{m}{s^2}$ or down

e) time it takes the soap to stop moving up.

(2) $v_f = v_0 + at \quad +4.1\frac{m}{s^2}$
$0 = 8.3 - 4.1(t) \qquad t = 1.90$ seconds

17. An Atwood machine has suspended masses of 3.00 kg and 6.00 kg. If the pulley mass and friction are negligible, determine the **acceleration** of the masses. Remember: make the direction of motion of each mass as its positive direction.

(3)



$a = \frac{(m_2 - m_1)g}{(m_1 + m_2)} = \frac{(6.34)(9.8)}{9.0kg} = 3.3\frac{m}{s^2}$

(16)