

SPH4U Quiz – Dynamics

NAME: Fox

19  
19

**True/False**

Indicate whether the sentence or statement is true or false.

③ F  
F  
T

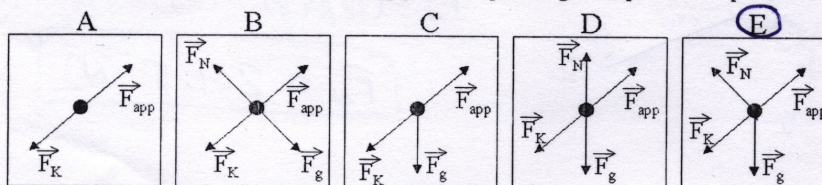
- The four fundamental forces of nature are gravity, electromagnetism, strong nuclear force and normal force.
- When forces acting on an object are in equilibrium, the object *must be at rest*.
- The same forces act on two objects having different masses. The lighter object will experience the *greater acceleration* provided the forces are not "balanced."

**Multiple Choice**

Identify the letter of the choice that best completes the statement or answers the question.

E

- The free-body diagram of a block being pushed up a rough ramp is best represented by

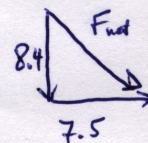


- A
- B
- C
- D
- E

③

C

- An object has two forces acting on it: 8.4 N [S] and 7.5 N [E]. The magnitude of the net force is
  - $1.3 \times 10^2$  N
  - 16 N
  - 11 N
  - 4.0 N
  - 0.9 N



B

- An elevator accelerates downward. What is the relationship between the gravitational force  $\vec{F}_g$  acting on the elevator and the tension  $\vec{F}_T$  in the cable that supports the elevator?
  - $|\vec{F}_g| = |\vec{F}_T|$
  - $|\vec{F}_g| > |\vec{F}_T|$
  - $|\vec{F}_g| < |\vec{F}_T|$
  - $|\vec{F}_g| \geq |\vec{F}_T|$
  - $|\vec{F}_g| \leq |\vec{F}_T|$

**Short Answer (Show ALL work)**

- A 40 kg sprinter starts from rest and 2.0 s later is running at a speed of 8.0 m/s. What is the average net horizontal force acting on her? What exerts this force? (4)

④

$$a = ?$$

$$F_{\text{net}} = ?$$

$$\vec{v}_2 = \vec{v}_1 + \vec{a} \Delta t$$

$$8 = 0 + a(2.0)$$

$$a = 4 \text{ m/s}^2 \text{ [fwd]}$$

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$$\vec{F}_{\text{net}} = m\vec{a}$$

$$= (40)(4)$$

$$= 160 \text{ N [fwd]}$$

The ground exerts this forward force on the sprinter.



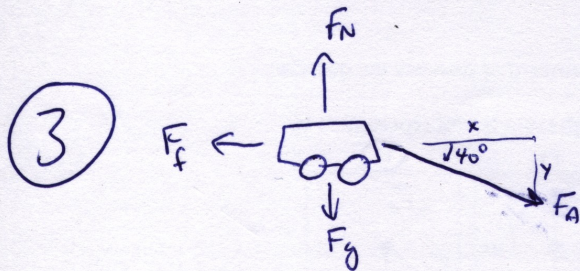
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Problem – Give a FULL solution to the following.

8. Selma pushes a lawn mower ( $m = 18 \text{ kg}$ ), starting from rest across a horizontal lawn by applying a force of  $39 \text{ N}$  straight along the handle which is inclined at an angle of  $40^\circ$  above the horizontal. The magnitude of the mower's acceleration is  $1.2 \text{ m/s}^2$  and the acceleration lasts for  $0.71 \text{ s}$ . After the acceleration ends, the mower moves with constant velocity. Determine the magnitude of

- a) the normal force on the mower. (3)



$$\Sigma F_y = 0$$

$$F_N - F_g - F_{Ay} = 0$$

$$F_N - (18)(9.8) - (39)\sin 40^\circ = 0$$

$$F_N = 201.5 \text{ N}$$

- b) the frictional force on the mower. (3)

(3)

$$\Sigma \vec{F}_x = m\vec{a}_x$$

$$\vec{F}_{Ax} - \vec{F}_f = m\vec{a}_x$$

$$(39)\cos 40^\circ - F_f = (18)(1.2)$$

$$\vec{F}_f = 8.3 \text{ N [backwards]}$$

- c) The maximum velocity of the mower. (3)

(3)

$$\vec{a} = \frac{\vec{F}_{net}}{m}$$

$$= 1.2 \text{ m/s}^2 \text{ [fwd]}$$

$$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$$

$$= 0 + (1.2)(0.71)$$

$$\vec{v}_2 = 0.85 \text{ m/s [fwd]}$$