Name: Key

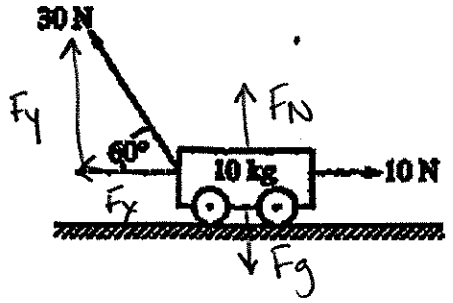
AP Physics

Period _____

Date _____

Review #2 (Dynamics)

1) The cart of mass 10 kg shown below moves without frictional loss on a level table.



A 10 N force pulls on the cart horizontally to the right. At the same time, a 30 N force at an angle of 60° above the horizontal pulls on the cart to the left. What is the magnitude of the horizontal acceleration of the cart?

A) 2.5 m/s^2

(B) 0.5 m/s^2

C) 1.6 m/s^2

D) 2.0 m/s^2

E) 2.6 m/s^2

$\Sigma F = ma$

$10N - 30N\cos 60^\circ = 10kg(a)$

$a = \frac{-5}{10} = -\frac{1}{2}$

2) If F_1 is the magnitude of the force exerted by the Earth on a satellite in orbit about the Earth and F_2 is the magnitude of the force exerted by the satellite on the Earth, then which of the following is true?

A) F_2 is much greater than F_1.

B) F_1 is much greater than F_2.

C) F_2 is slightly greater than F_1.

D) F_1 is slightly greater than F_2.

(E) F_1 is equal to F_2.

N3L equal forces

3) Three forces act on an object. If the object is in equilibrium, which of the following must be true? (Forces balanced)

(I.) The vector sum of the three forces must equal zero.

~~II.~~ The magnitudes of the three forces must be equal.

~~III.~~ All three forces must be parallel.

A) II only

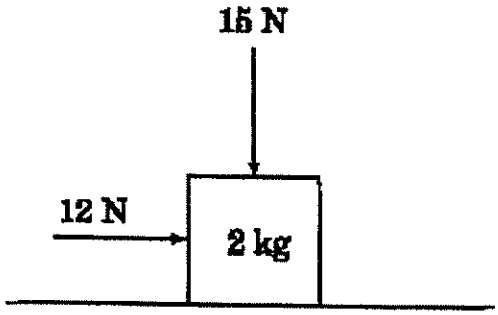
B) II and III only

(C) I only

D) I, II, and III

E) I and III only

4) A block of mass 2 kg slides along a horizontal tabletop. A horizontal applied force of 12 N and a vertical applied force of 15 N act on the block, as shown below.



If the coefficient of kinetic friction between the block and the table is 0.2, the frictional force exerted on the block is most nearly

A) 1 N

B) 3 N

C) 5 N

(D) 7 N

E) 4 N

① $\Sigma F = 0N$

$F_N - F_g - 15N = 0N$

$F_N = 15N + 20N$

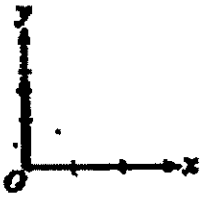
$= 35N$

② $F_f = \mu F_N$

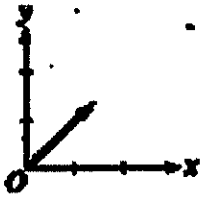
$= (.2)(35)$

5) An object of mass m is initially at rest and free to move without friction in any direction in the xy-plane. A constant net force of magnitude F directed in the $+x$ direction acts on the object for 1 s. Immediately thereafter a constant net force of the same magnitude F directed in the $+y$ direction acts on the object for 1 s. After this, no forces act on the object. Which of the following vectors could represent the velocity of the object at the end of 3 s, assuming the scales on the x and y axes are equal?

A)



(B)

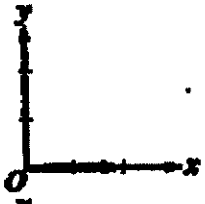


F_x gives V_x

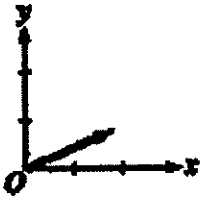
F_y gives V_y

equal F equals equal ΔV

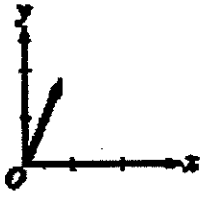
C)



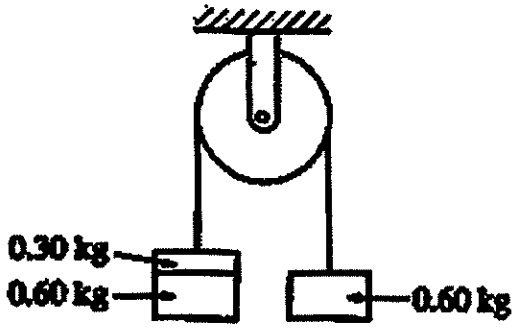
D)



E)



6) Two 0.60-kilogram objects are connected by a thread that passes over a light, frictionless pulley, as shown below.



The objects are initially held at rest. If a third object with a mass of 0.30 kilogram is added on top of one of the 0.60-kilogram objects as shown and the objects are released, the magnitude of the acceleration of the 0.30-kilogram object is most nearly

A) 6.0 m/s^2
B) 10.0 m/s^2
C) 1.0 m/s^2
D) 3.0 m/s^2
(E) 2.0 m/s^2

$a = \frac{F_{net}}{m_{net}} = \frac{(.9)g - (.6)g}{.9 + .6}$

$= \frac{.3(10)}{1.5} \quad \frac{3}{1.5}$

7) A ball falls straight down through the air under the influence of gravity. There is a retarding force F on the ball with magnitude given by $F = bv$, where v is the speed of the ball and b is a positive constant. The magnitude of the acceleration a of the ball at any time is equal to which of the following?

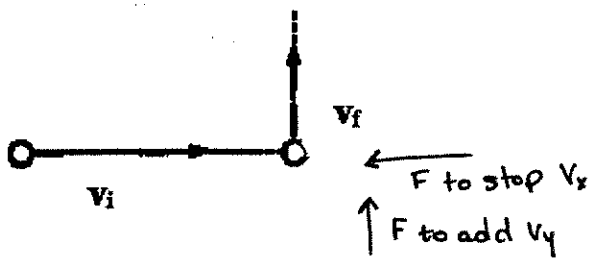
(A) $g - bv/m$ ← They made down +
B) bv/m
C) g/b
D) $g + bv/m$
E) $g - b$

$a = \frac{F_{net}}{m} = \frac{-F_{air} + F_g}{m}$

$= \frac{-bv + mg}{m}$

$= -\frac{bv}{m} + g$

8) A ball initially moves horizontally with velocity v_i, as shown below.



It is then struck by a stick. After leaving the stick, the ball moves vertically with a velocity v_f, which is smaller in magnitude than v_i.

Which of the following vectors best represents the direction of the average force that the stick exerts on the ball?

$F_{net} = ma$

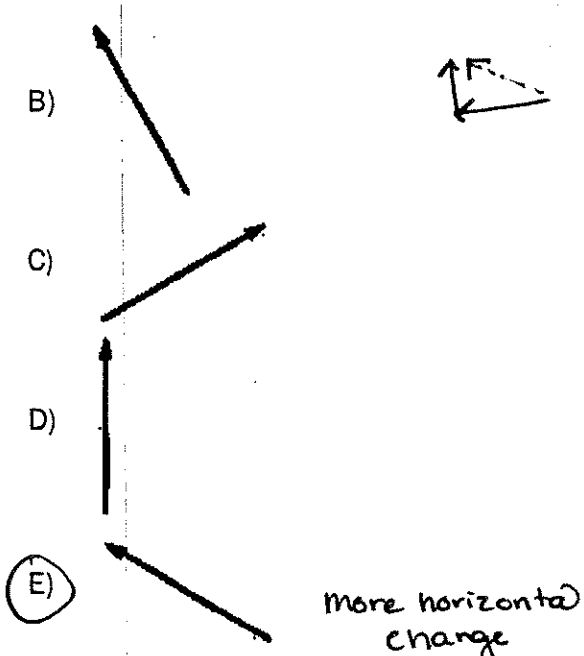
A)

B)

C)

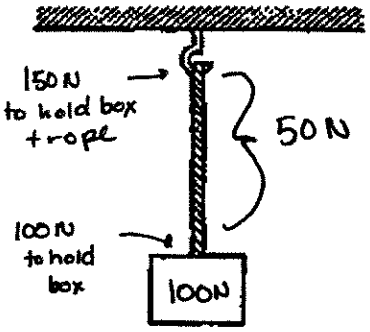
D)

E)



more horizontal change than vertical

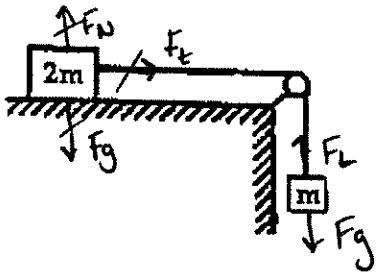
9) A uniform rope of weight 50 newtons hangs from a hook as shown below.



A box of weight 100 newtons hangs from the rope. What is the tension in the rope?

A) 100 N throughout the rope
B) 150 N throughout the rope
C) 75 N throughout the rope
D) 50 N throughout the rope
(E) It varies from 100 N at the bottom of the rope to 150 N at the top.

10) A block of mass $2m$ can move without friction on a horizontal table. This block is attached to another block of mass m by a cord that passes over a frictionless pulley, as shown below.



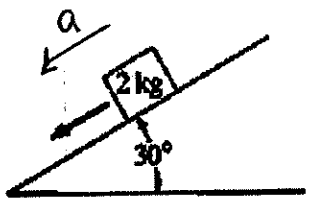
If the masses of the cord and the pulley are negligible, what is the magnitude of the acceleration of the descending block?

A) g/4
B) g
C) 2g/3
D) zero
(E) g/3

$a = \frac{F_{net}}{m_{net}} = \frac{mg}{m+2m}$

$\frac{mg}{3m}$

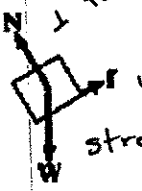
Questions 11 and 12 refer to the following:



A 2-kilogram block slides down a 30° incline as shown above with an acceleration of 2 meters per second squared.

11) Which of the following diagrams best represents the gravitational force W, the frictional force f, and the normal force N that act on the block?

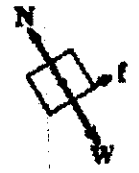
A)


(B)


⊥ to surface
f uphill
straight down

C)


D)

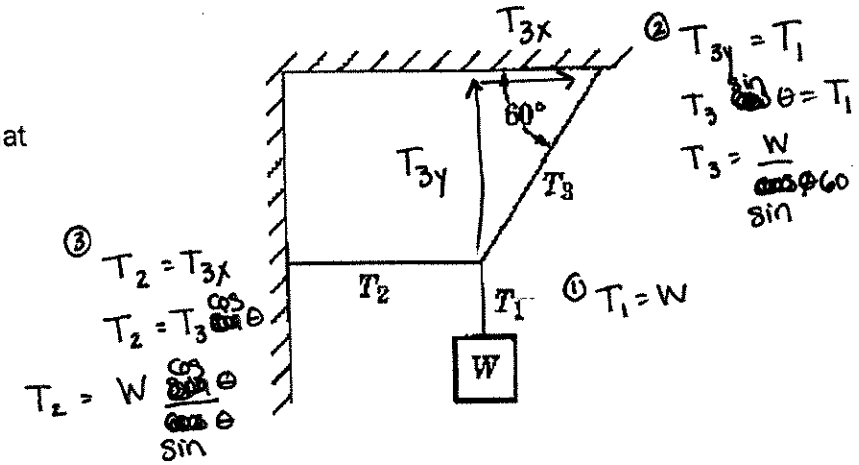

E)


12) The magnitude of the frictional force along the plane is most nearly

A) 16 N
B) 2.5 N
C) 10 N
D) 5 N
(E) 6 N

$\Sigma F = ma$
$F_f - F_{g\parallel} = ma$
$F_f = ma + mg\sin\theta$
$= (2)(-2) + (2)(10)\sin 30$
$-4 + 10$

13) A system in equilibrium consists of an object of weight W that hangs from three ropes, as shown below.



② $T_{3y} = T_1$
$T_3 \sin\theta = T_1$
$T_3 = \frac{W}{\cos\theta \sin 60}$
③ $T_2 = T_{3x}$
$T_2 = T_3 \cos\theta$
$T_2 = W \frac{\cos\theta}{\sin\theta}$
① $T_1 = W$

$\frac{\sin}{\cos} = \tan$
$\frac{\cos}{\sin} = \tan^{-1}$

The tensions in the ropes are T_1, T_2, and T_3. Which of the following are correct values of T_2 and T_3?

A) ~~$T_2 = W\tan 60°$~~
~~$T_3 = W\sin 60°$~~

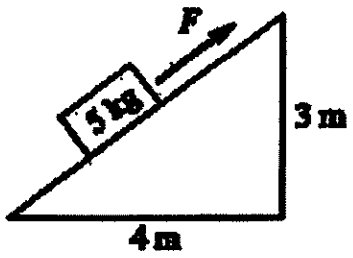
B) ~~$T_2 = W\tan 60°$~~
~~$T_3 = W/\sin 60°$~~

(C) $T_2 = W/\tan 60°$
~~$T_3 = W/\sin 60°$~~

D) ~~$T_2 = W\tan 60°$~~
~~$T_3 = W/\cos 60°$~~

E) $T_2 = W/\tan 60°$
~~$T_3 = W/\cos 60°$~~

14) A block of mass 5 kilograms lies on an inclined plane, as shown below.



$\sin\theta = \frac{O}{H} = \frac{3}{5}$

$\cos\theta = \frac{A}{H} = \frac{4}{5}$

$\Sigma F = 0N$

$F_A - F_{g\parallel} - F_f = 0N$

$F_A = F_{g\parallel} + F_f = F_g \sin\theta + \mu F_N$

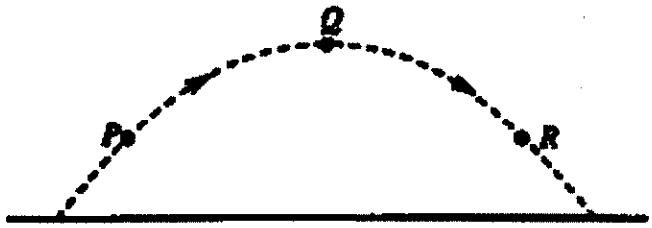
$= mg\sin\theta + \mu mg\cos\theta$

$= (5)(10)(\frac{3}{5}) + (.3)(5)(10)(\frac{4}{5})$

The horizontal and vertical supports for the plane have lengths of 4 meters and 3 meters, respectively. The coefficient of friction between the plane and the block is 0.3. The magnitude of the force *F* necessary to pull the block up the plane with constant speed is most nearly

A) 50 N
B) 58 N
C) 49 N
D) 30 N
(E) 42 N

15)

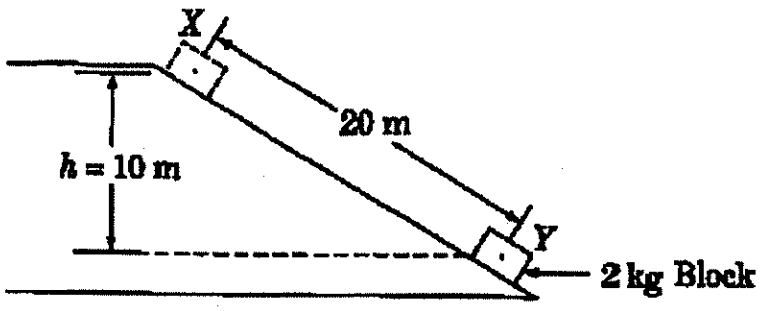


A ball is thrown and follows the parabolic path shown above. Air friction is negligible. Point Q is the highest point on the path. Points P and R are the same height above the ground.
Which of the following best indicates the direction of the net force, if any, on the ball at point Q?

A) →
(B) ↓
C) ←
D) There is no net force on the ball at point Q.
E) ↘

Fg only Force!

Questions 16 and 17 refer to the following:



m V_0 d

A 2 kg block, starting from rest, slides 20 m down a frictionless inclined plane from X to Y, dropping a vertical distance of 10 m as shown above.

Y

16) The speed of the block at point Y is most nearly

A) 10 m/s
B) 7 m/s
C) 20 m/s
D) 100 m/s
(E) 14 m/s

$\sin\theta = \frac{O}{H} = \frac{10}{20}$

① $a = \frac{F_{net}}{m} = \frac{F_{g\parallel}}{m} = \frac{mg\sin\theta}{m}$

$= (10)\frac{(10)}{20}$

$= 5\ m/s^2$

② $V = \sqrt{v_0^2 + 2a\Delta x}$

$= \sqrt{2(5)(20)}$

$= 14\ m/s$

↳ This was probably first on real AP

17) The magnitude of the net force on the block while it is sliding is most nearly

A) 5.0 N
B) 0.1 N
C) 10.0 N
D) 2.5 N
E) 0.4 N

$\Sigma F = F_{g\parallel}$

$= mg\sin\theta$

$= (2)(10)\left(\frac{10}{20}\right)$

$= 10N$

1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)	16)	17)
B	E	C	D	B	E	A	E	E	E	B	E	C	E	B	E	C