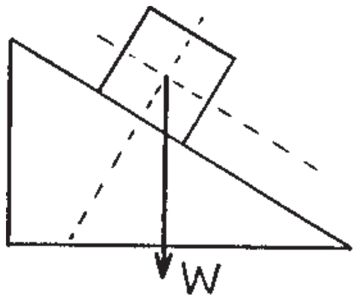
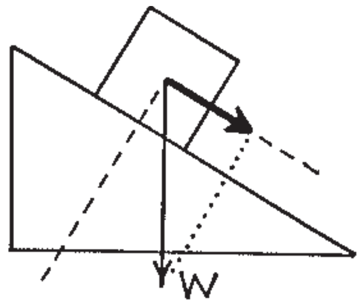
Name ______________________ Class ______________ Date ______________

Concept-Development Practice Page **6-4**

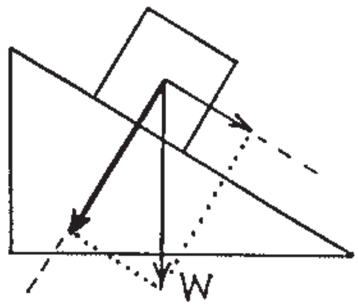
Force Vector Components



1. The weight of the block is represented by vector **W**. We show axes parallel and perpendicular to the surface of the inclined plane.

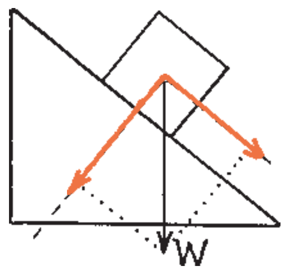


2. **W** has a component parallel to the surface (bold vector). Acceleration down the incline is due to this component.



3. **W** also has a component perpendicular to the surface (bold vector). This component gives the force pressing the block against the surface, and is equal and opposite to the normal force (not shown).

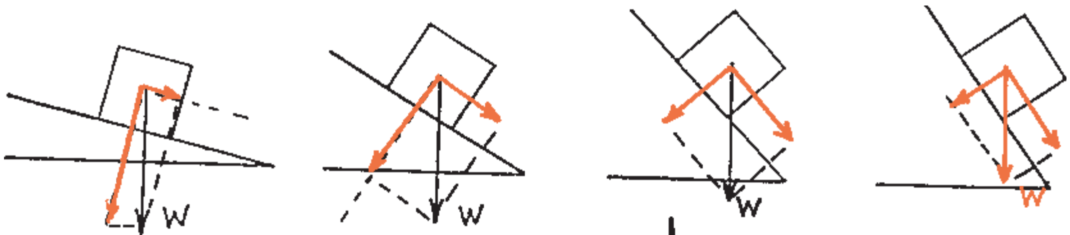
4. Here is the same block on a steeper incline. Draw in the components.



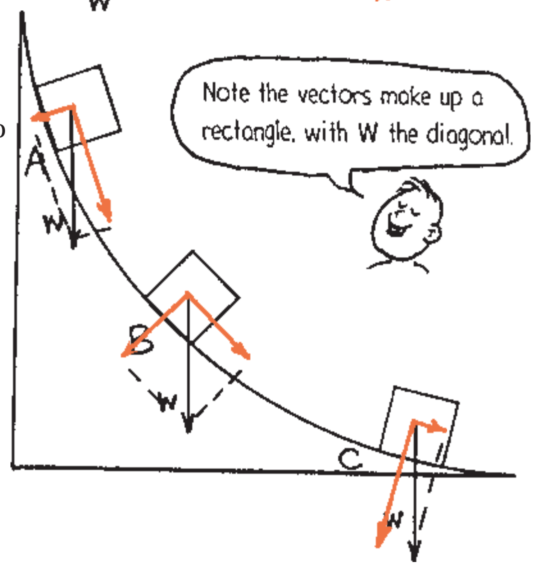
a. For a steeper incline, the component parallel to the incline is (greater) (the same) (less).

b. For a steeper incline, the component perpendicular to the incline (increases) (stays the same) (decreases).

5. Draw components of each weight vector parallel and perpendicular to the surface for the blocks below.



6. A block slides down a friction-free ramp as shown. Construct components of the weight vector: one parallel to the surface at A, B, and C, and the other perpendicular to the surface at these locations.



a. At which location is the component parallel to the ramp surface greatest? A

b. At which location is the acceleration of the block along the ramp greatest? A

c. At which location is the acceleration of the block along the ramp least? C

d. *True or false:* The speed of the block on this ramp is greatest where acceleration is least. True

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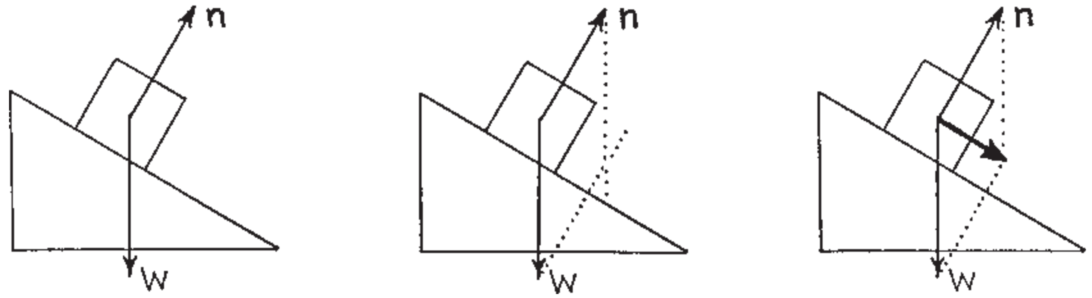
Vector Resultants

On the previous page we considered only the weight vector **W** for a block on a friction-free incline. Here we also consider the normal force **n**.



1. With no friction, only two forces act: **W** and **n**. We put the tail of **n** at the block's center to coincide with the tail of **W**—so we can better find the resultant via the parallelogram rule.
2. We construct a parallelogram (dotted lines) whose sides are **W** and **n** to find the resultant **W** + **n**.
3. The resultant is the diagonal as shown (bold vector). This is the net force on the block.

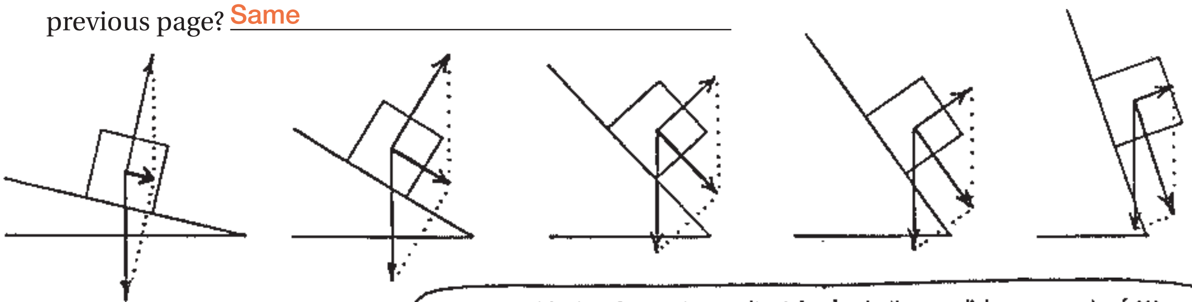
Net force and acceleration are always in the same direction. Any object accelerating down any incline has a net force parallel to that incline.

4. Note the net forces (bold vectors) for the blocks below.

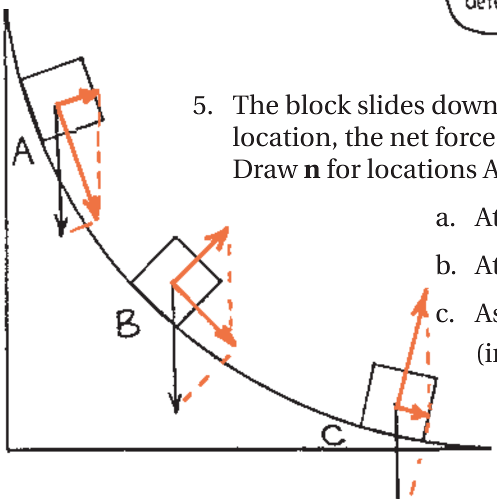
   a. For a steeper incline, **n** (increases) (stays the same) (decreases).

   b. For a steeper incline, the net force (increases) (stays the same) (decreases).

   c. How does the net force compare to the parallel component of **W** as determined on the previous page? Same



Without a friction force, the resultant is simply the parallel component of **W** as determined on the previous page. Here we see another way to view the same thing.



5. The block slides down a curved ramp (left), as on the previous page. In each location, the net force (resultant of **W** and **n**) is parallel to the ramp surface. Draw **n** for locations A, B, and C, and construct parallelograms and the net forces.

   a. At which location is the net force greatest? A

   b. At which location is the acceleration greatest? A

   c. As the speed of the block increases, acceleration (increases) (is constant) (decreases).

6. On inclined *flat* planes, acceleration down the incline (is constant) (varies). On curved inclines, acceleration (is constant) (varies).

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