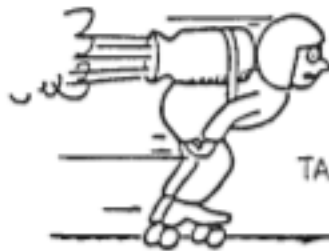## Force and Acceleration

1. Skelly the skater, total mass 25 kg, is propelled by rocket power.

   a. Complete Table I
      (neglect resistance)

   TABLE I

FORCE	ACCELERATION
100 N	
200 N	
	10 m/s²

   b. Complete Table II for a
      constant 50-N resistance:

   TABLE II

FORCE	ACCELERATION
50 N	0 m/s²
100 N	
200 N	

2. Block A on a horizontal friction-free table is accelerated by a force from
   a string attached to Block B. B falls vertically and drags A horizontally.
   Both blocks have the same mass m. (Neglect the string's mass.)

   (Circle the correct answers)

   a. The *mass* of the system [A + B] is (m) $(2\,m)$.

   b. The *force* that accelerates [A + B] is the weight of (A) (B) (A + B).

   c. The weight of B is $(mg/2)$ (mg) $(2\,mg)$.

   d. Acceleration of [A + B] is (less than g) (g) (more than g).

   e. Use $a =$ to show the acceleration of [A + B] as a fraction of g._____
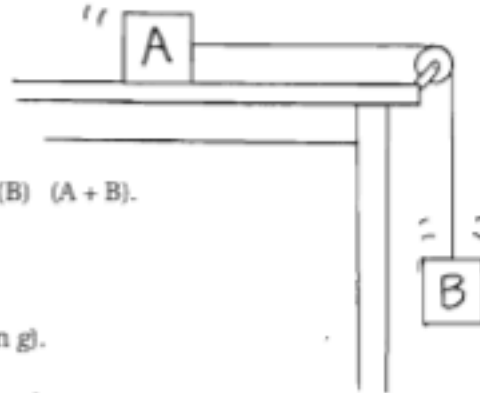
   If B were allowed to fall by itself, not dragging A, then wouldn't its acceleration be g?

   Yes, because the force that accelerates it would only be acting on its own mass — not twice the mass!
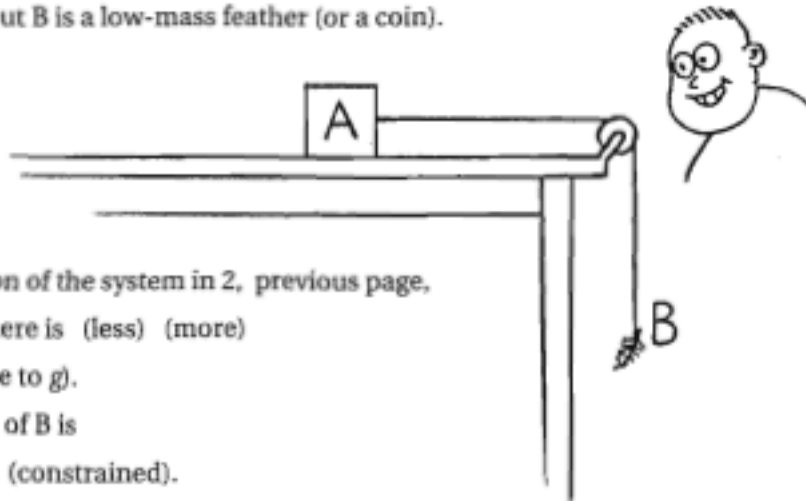
   To better understand this, consider 3 and 4 on the other side!

Force and Acceleration continued

3. Suppose A is still a 1-kg block, but B is a low-mass feather (or a coin).

   a. Compared to the acceleration of the system in 2, previous page, the acceleration of [A + B] here is (less) (more) and is (close to zero) (close to g).

   b. In this case the acceleration of B is (practically that of free fall) (constrained).

4. Suppose A is a feather or coin, and B has a mass of 1 kg.
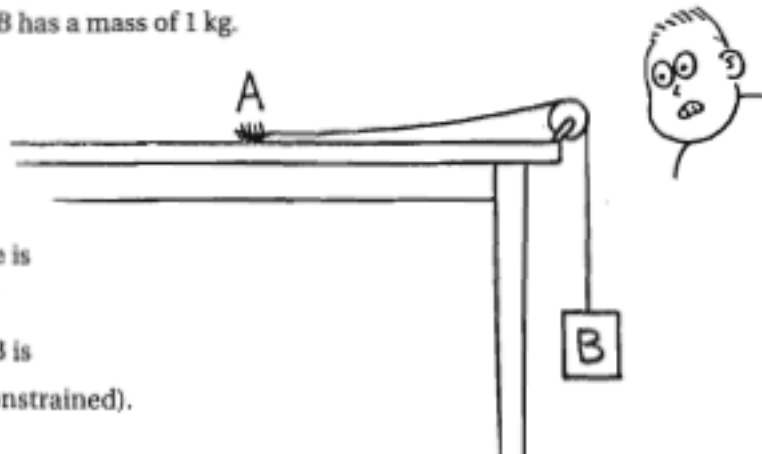
   a. The acceleration of [A + B] here is (close to zero) (close to g).

   b. In this case the acceleration of B is (practically that of free fall) (constrained).

5. Summarizing 2, 3, and 4, where the weight of one object causes the acceleration of two objects, we see the range of possible accelerations is

   (between zero and g) (between zero and infinity) (between g and infinity).

6. A ball rolls down a uniform-slope ramp.

   a. Acceleration is (decreasing) (constant) (increasing).

   b. If the ramp were steeper, acceleration would be (more) (the same) (less).

   c. When the ball reaches the bottom and rolls along the smooth level surface it (continues to accelerate) (does not accelerate).

Newton's 2nd Law

7. Forces are shown on the objects below. For each:
    a. Draw and label the net force vector on the figure
    b. Below the figure, draw and label the object's acceleration vector.

8. In the figures below, one force is missing. Use the given direction of acceleration to determine the missing force and draw it directly on the object.

9. The figure shows an acceleration-versus-force graph for an object of mass m. Data have been plotted as individual points, and a line has been drawn through the points.

   Draw and label, directly on the figure, the acceleration-versus-force graphs for objects of mass

   a. $2m$ b. $0.5m$

   Use triangles ▲ to show four points for the object of mass $2m$, then draw a line through the points. Use squares ■ for the object of mass $0.5m$.

Acceleration

Force (rubber bands)

10. A constant force applied to object A causes A to accelerate at 5 m/s². The same force applied to object B causes an acceleration of 3 m/s². Applied to object C, it causes an acceleration of 8 m/s².

    a. Which object has the largest mass? _____

    b. Which object has the smallest mass? _____

    c. What is the ratio of mass A to mass B? $(m_A/m_B) =$ _____

11. A constant force applied to an object causes the object to accelerate at 10 m/s². What will the acceleration of this object be if

    a. The force is doubled? _____   b. The mass is doubled? _____

    c. The force is doubled and the mass is doubled? _____

    d. The force is doubled and the mass is halved? _____

12. A constant force applied to an object causes the object to accelerate at 8 m/s². What will the acceleration of this object be if

    a. The force is halved? _____   b. The mass is halved? _____

    c. The force is halved and the mass is halved? _____

    d. The force is halved and the mass is doubled? _____