Unit: Forces   Physics
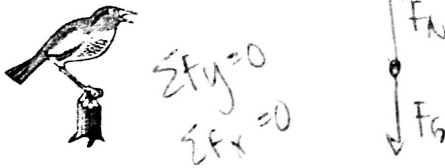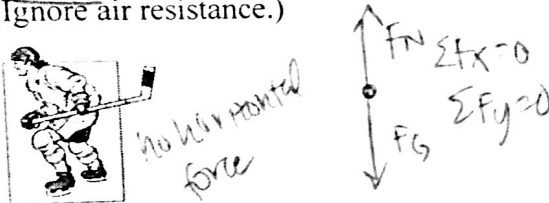
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Free-Body Diagrams

For each picture, draw the free-body diagram (force diagram) and indicate the net force, if any.
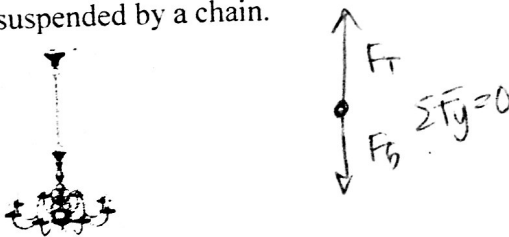
1. A bird sits motionless on a perch.

$\Sigma F_y = 0$
$\Sigma F_x = 0$

F_N
F_G

2. A hockey player glides at constant velocity across frictionless ice. (Ignore air resistance.)

F_N $\Sigma F_x = 0$
no horizontal force
F_G $\Sigma F_y = 0$

3. A baseball player slides head-first into second base.

F_N
$\rightarrow F_K$
$\Sigma F_x = \rightarrow$
F_G

4. A chandelier hangs from the ceiling, suspended by a chain.

F_T
$\Sigma F_y = 0$
F_G

5. A bucket of water is raised out of a well at constant velocity.

F_T
$\Sigma F_y = 0$
F_G
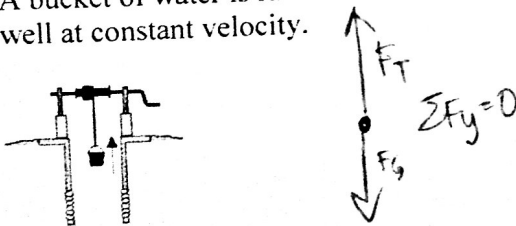
6. A skydiver has just jumped out of an airplane and is accelerating toward the ground.

F_D
F_G
$\Sigma F_y = F_G - F_D$

7. A skydiver falls through the air at terminal velocity.

F_D
F_G
$\Sigma F_y = 0$

8. A hurdler is moving horizontally as she clears a hurdle. (Ignore air resistance.)

F_G
$\Sigma F_y \downarrow$
$\Sigma F_x = 0$

9. An airplane moves through the air in level flight at constant velocity.

F_D
F_G
$\Sigma F = 0$

10. A sled is pulled through the snow at constant velocity. (Note that the rope is at an angle.)

F_N F_T
F_K F_G
$\Sigma F_y = 0$
$\Sigma F_x = 0$
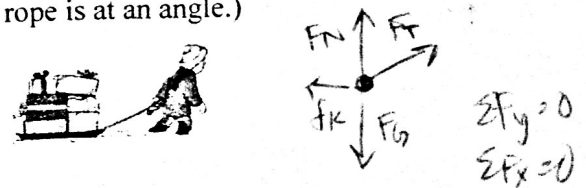
ightward force is applied to a 6-kg object to move it across a rough surface at constant velocity. The object encounters 15
of frictional force. Use the diagram to determine the gravitational force, normal force, net force, and applied force.
eglect air resistance.)

F_{norm} = 58.9N

F_{frict} = 15 N F_{app} = 15N

F_{grav} = 58.9 N

m = 6 kg
a = 0 m/s/s
F_{net} = 0 N
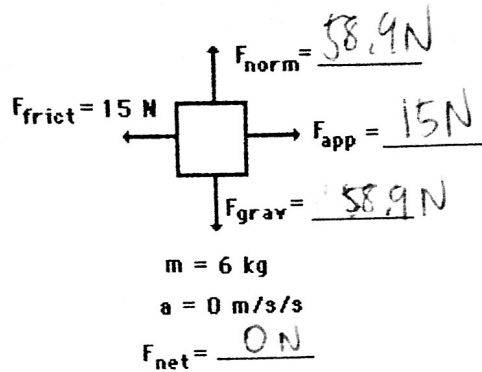
A rightward force is applied to a 10-kg object to move it across a rough surface at constant velocity. The coefficient of
friction between the object and the surface is 0.2. Use the diagram to determine the gravitational force, normal force, applied
force, frictional force, and net force. (Neglect air resistance.)

F_{norm} = 98.1N

F_{frict} = 19.6N F_{app} = 19.6N

μ = 0.2 F_{grav} = 98.1N

m = 10 kg
a = 0 m/s/s
F_{net} = 0N
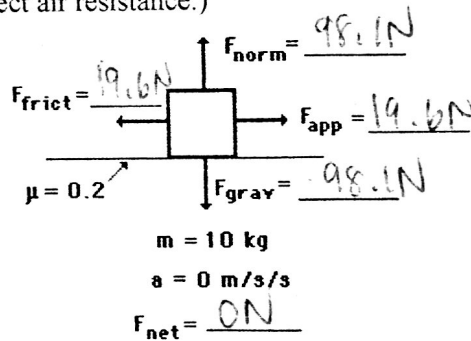
25.   A rightward force is applied to a 5-kg object to move it across a rough surface with a rightward acceleration of 2 m/s^2.
       The coefficient of friction between the object and the surface is 0.1. Use the diagram to determine the gravitational force,
       normal force, applied force, frictional force, and net force. (Neglect air resistance.)

F_{norm} = 49.05N

F_{frict} = 4.9N F_{app} = 5.1N

μ = 0.1 F_{grav} = 49.05 N

m = 5 kg
a = 2 m/s/s, right
F_{net} = 10N, right