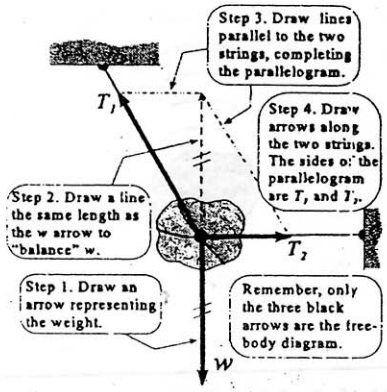
Free-Body Exercises: Linear Motion

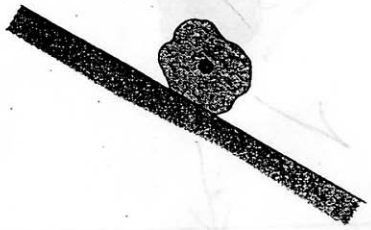
In each case the rock is acted on by one or more forces. All drawings are in a vertical plane, and friction is negligible except where noted. Draw accurate free-body diagrams showing all forces acting on the rock. LM-1 is done as an example, using the "parallelogram" method. For convenience, you may draw all forces acting at the center of mass, even though friction and normal reaction force act at the point of contact with the surface. Please use a ruler, and do it in pencil so you can correct mistakes. Label forces using the following symbols: w = weight of rock, T = tension, n = normal reaction force, f = friction.

LM-1. Equilibrium (Example)

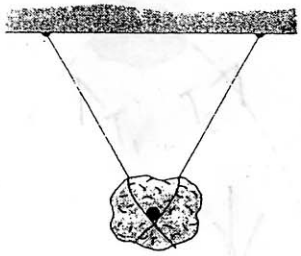


LM-2. Equilibrium

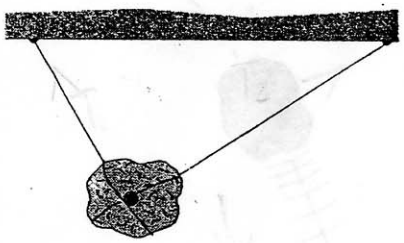
LM-3. Friction prevents sliding.



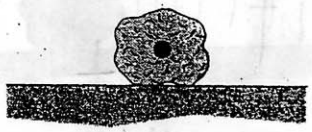
LM-4. Equilibrium



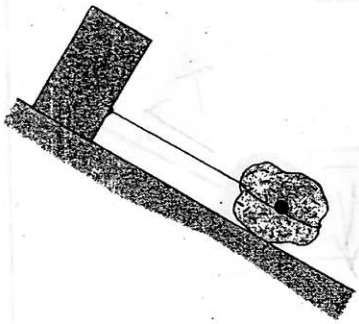
LM-5. Equilibrium



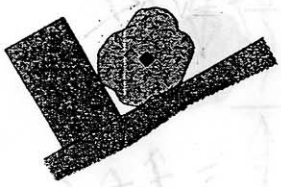
LM-6. Equilibrium



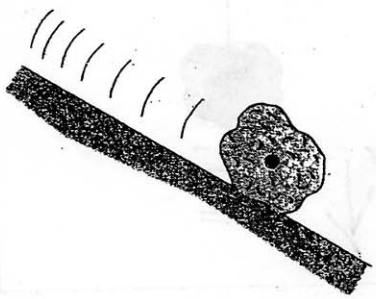
LM-7. Equilibrium



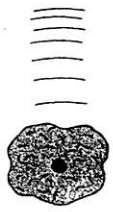
LM-8. Equilibrium



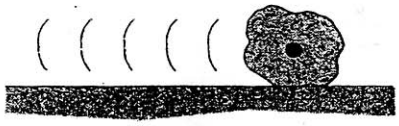
LM-9. Rock is sliding on a frictionless incline.



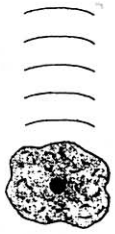
LM-10. Rock is falling. No friction.



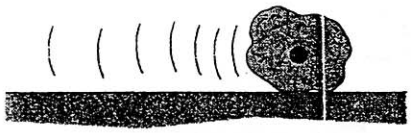
LM-11. Rock is sliding at constant speed on a frictionless surface.



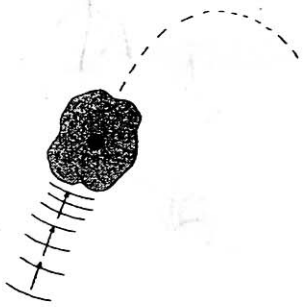
LM-12. Rock is falling at constant (terminal) velocity.



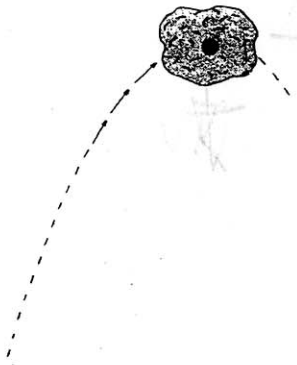
LM-13. Rock is decelerating because of kinetic friction.



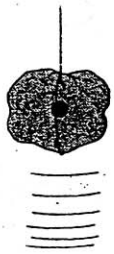
LM-14. Rock is rising in a parabolic trajectory.



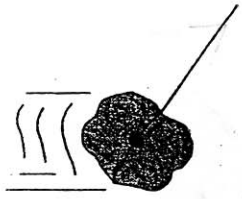
LM-15. Rock is at the top of a parabolic trajectory.



LM-16. Rock is tied to a rope and pulled straight upward, accelerating at 9.8 m/s^2. No friction.



LM-17. Rock is tied to a rope and pulled so that it moves horizontally at constant velocity. (There must be friction.)



LM-18. Rock is tied to a rope and pulled so that it accelerates horizontally at 2g. No friction.