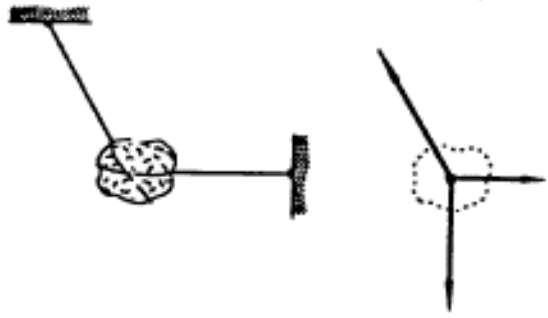
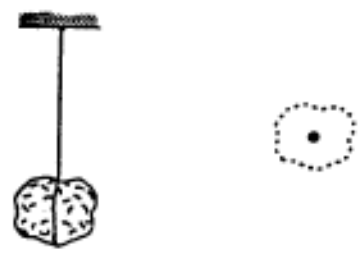








Free-Body Diagrams

In each case, a 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. Please use a ruler, and do it in pencil so you can correct mistakes. The first one is done as an example.

<p>1. Static</p> 	<p>2. Static</p> 
<p>3. Rock is falling. No air friction.</p> 	<p>4. Static</p> 
<p>5. Static</p> 	<p>6. Static</p> 
<p>7. Static</p> 	<p>8. Static</p> 

9. Sliding without friction.



10. Static friction prevents sliding.



11. Sliding at constant speed without friction.



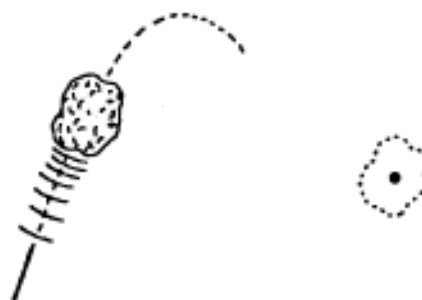
12. Falling at constant (terminal) velocity.



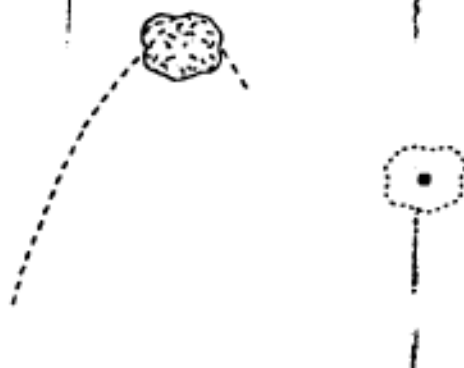
13. Decelerating because of kinetic friction.



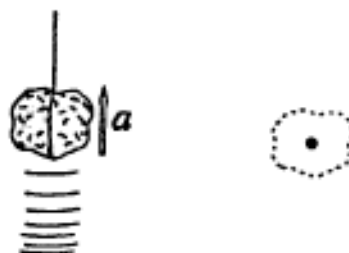
14. Rising in a parabolic trajectory.



15. At the top of a parabolic trajectory.



16. Tied to a rope and pulled straight upward. Accelerating upward at 9.8 m/s^2 . No friction.



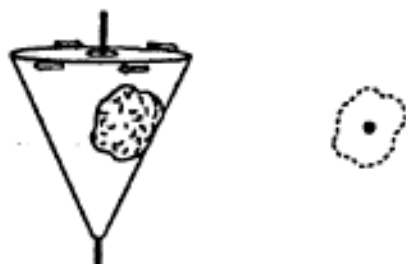
25. Swinging on a rope, at the top of a vertical circle.



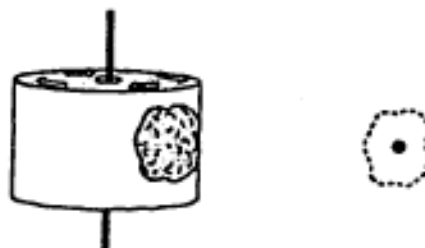
26. Riding on a horizontal disk that is rotating at constant speed about its vertical axis. Friction prevents rock from sliding. Rock is moving straight out of the paper.



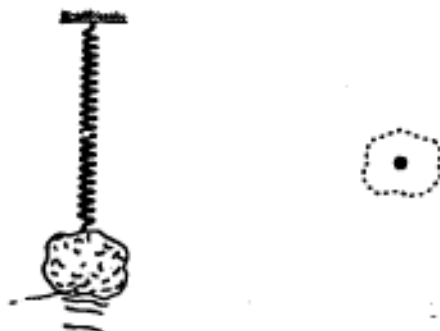
27. Resting against the frictionless inside wall of a cone rotating about its vertical axis at constant speed. Not accelerating vertically. Moving straight out of the paper.



28. Stuck by friction against the inside wall of a drum rotating about its vertical axis at constant speed. Rock is moving straight out of the paper.



29. Suspended from a spring. Pulled downward slightly and released. No friction.



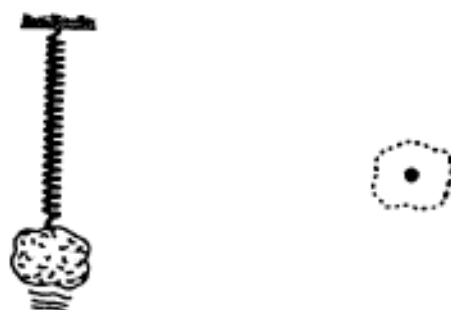
30. Suspended from a spring. Instantaneously at rest at the top of its travel.



31. Suspended from a spring. Moving downward through the equilibrium position. No friction.



32. Suspended from a spring. Moving upward through the equilibrium position. No friction.



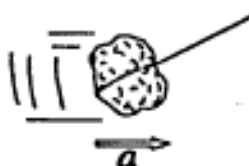
17. Tied to a rope and pulled straight downward. Accelerating downward at 19.6 m/s^2 . No friction.



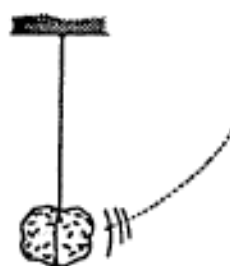
18. Tied to a rope and pulled so that the rock moves horizontally at constant velocity. Note: There must be air friction in this case.



19. Tied to a rope and pulled so that the rock accelerates horizontally at $2g$. No air friction.



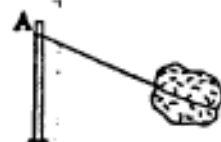
20. Swinging on a rope, at lowest position. No friction.



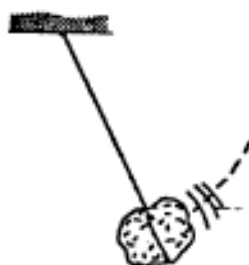
21. Tied to a post and moving in a circle at constant speed on a frictionless horizontal surface. Coming straight out of the paper.



22. Tied to point A by a string. Moving in a horizontal circle at constant speed. Not resting on a solid surface. No friction. Coming straight out of the paper.



23. Swinging on a rope. No friction.



24. Tied to point B. Moving downward in a vertical circle with string horizontal. No friction.

