Answer #353

The answer is (c); the ball will nearly sink completely and leave an inwardly sloping "blast radius" in its wake.

Alternate high-res version.

When the ball bearing impacts the sand, sand "squirts out" (i.e. is displaced) from the area where the bearing lands. How *much* sand is displaced depends on the mass of the bearing and the impact speed -- i.e. the momentum of the projectile. After the impact, as the sand begins to settle, the slope of the "blast cone" is then determined by how well the sand particles stack onto each other or slide over each other. If the particles stick quite well the slope will be steeper; static friction is enough to keep the particles in place. If the particles do not stick together well, then they will slide down toward the bottom, resulting a crater of a shallower angle.

Another way of analyzing the situation is through energy dissipation. Energy from the collision is dissipated isotropically from the point of impact, meaning that the energy is radiated away evenly in all directions. If the target -- in our example the sand -- has uniform density, then this energy creates an impact shape that is also isotropic -- that is, the shape of a sphere! It much like dropping a pebble into a lake and watching the energy radiate away in circles -- except here the phenomena stops quickly because of the sand is much more dense.

Take home point? The impact is not spherical because of the shape of the projectile was a sphere!!

The same situation applies to large meteorites striking the surface of a planet or moon. Are all meteorites spherical? Certainly not! But most impact craters *are* circular, owing to the isotropic energy dissipation. Sometimes in more rare conditions craters can form in a variety of different shapes, e.g. if the meteorite "skips" along the surface or if the material on the surface may be a bit more difficult to move or contains irregular densities.

More exciting crater shapes await for you in Question #354!

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