

Problems for UKYPT 2011/12

1. Gaussian cannon

A sequence of identical steel balls includes a strong magnet and lies in a nonmagnetic channel. Another steel ball is rolled towards them and collides with the end ball. The ball at the opposite end of the sequence is ejected at a surprisingly high velocity. Optimize the magnet's position for the greatest effect.

2. Bright waves

Illuminate a water tank. When there are waves on the water surface, you can see bright and dark patterns on the bottom of the tank. Study the relation between the waves and the pattern.

3. Drawing pins

A drawing pin (thumbtack) floating on the surface of water near another floating object is subject to an attractive force. Investigate and explain the phenomenon. Is it possible to achieve a repulsive force by a similar mechanism?

4. Magnet and coin

Place a coin vertically on a magnet. Incline the coin relative to the magnet and then release it. The coin may fall down onto the magnet or revert to its vertical position. Study and explain the coin's motion.

5. Rocking bottle

Fill a bottle with some liquid. Lay it down on a horizontal surface and give it a push. The bottle may first move forward and then oscillate before it comes to rest. Investigate the bottle's motion.