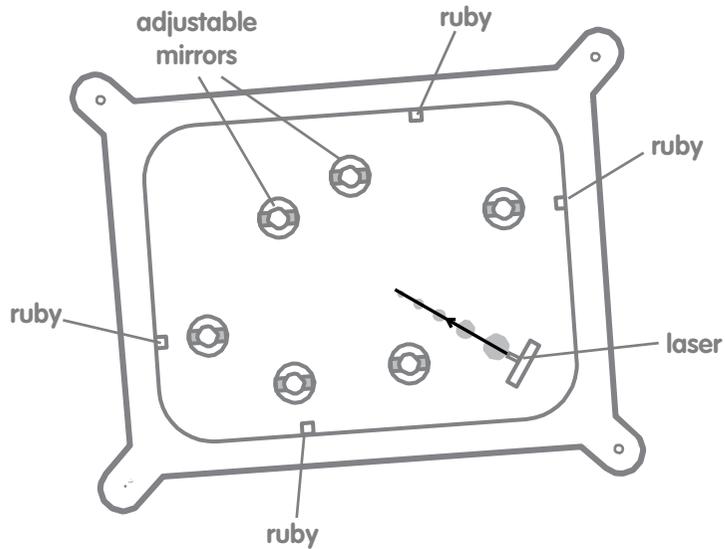


REFLECT IT

Challenge



The exhibit contains the world's most expensive rubies. Can you arrange the mirrors so the laser beam acts as a burglar alarm—illuminating as many rubies as possible?

Before you start

Remember your straight lines!

1. Note down 3 things you know about light.

A Light travels in straight lines

B Light is a form of energy

C Light can be reflected / refracted / diffracted

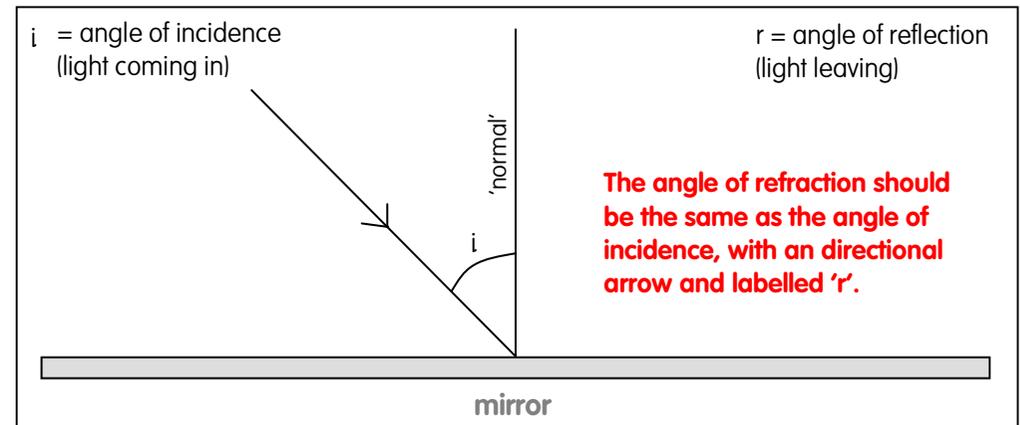
REFLECT IT

2. Choose one of the mirror pillars that is reflecting light. You are going to measure the angle at which the light travels into and away from the mirror. Measure from the **middle line** (the **normal**) of the protractor. Repeat the measurements for 4 different angles at which the light hits the mirror.

| | Angle of incidence | Angle of reflection |
|---|--|---------------------|
| 1 | | |
| 2 | Measured angles should be approximately the same on each side | |
| 3 | | |
| 4 | | |

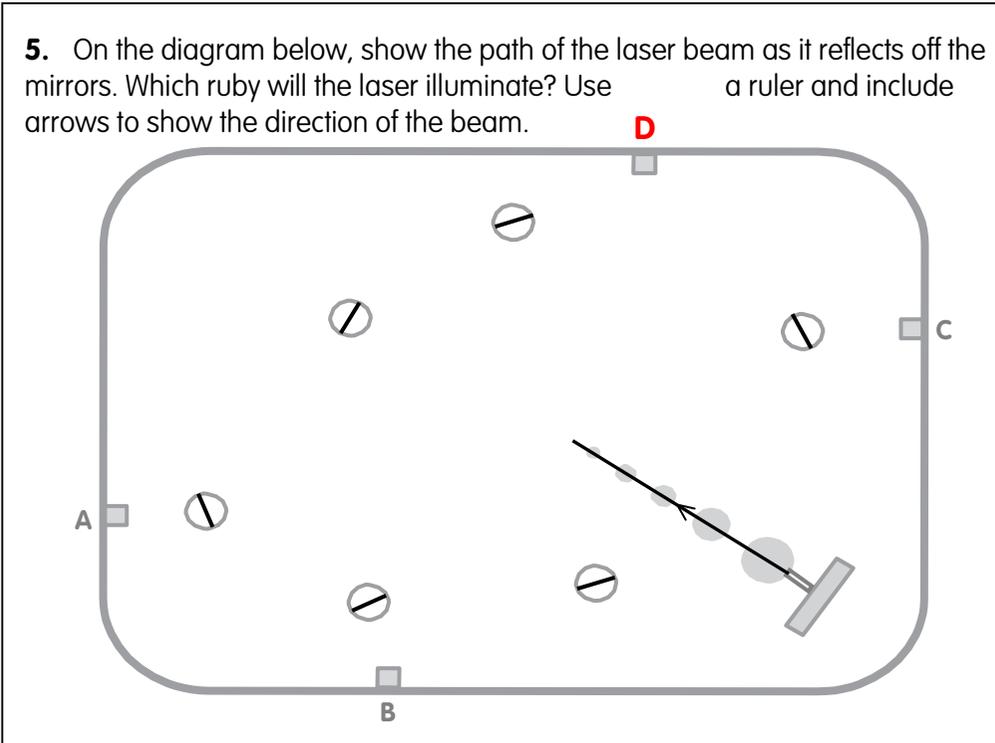
3. What pattern do you notice?

4. Using what you have observed, complete the diagram below.



REFLECT IT

5. On the diagram below, show the path of the laser beam as it reflects off the mirrors. Which ruby will the laser illuminate? Use a ruler and include arrows to show the direction of the beam.



LASER stands for **Light Amplification by Stimulated Emission of Radiation**. The light from lasers is said to be *coherent*. In other words, it is *all the same wavelength*.

Laser light is sometimes used in security systems in the way shown in this exhibit.

6. Can you name some other ways in which we use lasers?

Possible responses include: Optical disk drives; laser printers; barcode scanners; fibre-optic cables; laser surgery and skin treatments; cutting and welding; measuring range and speed (e.g moving vehicles); laser lighting displays in entertainment.

REFLECT IT

Most light sources emit light in many different directions at once



In lasers, the light waves are all parallel to one another



7. How might this property of lasers be useful?

(Hint: think about your suggestions for the ways in which we use them).

**The beam can be very directional / can be focussed on a small point.
The (light) energy can be focussed / concentrated.**

We can see the laser beam because the light energy is reflected off dust particles and surfaces, and this light enters our eyes.

8. What two differences in the laser beam do you notice between the start and at its furthest point?

**The beam is less bright at the furthest point.
The beam is less focussed / spreads out / disperses the further it travels.**

9. How can you explain this?

**The brightness is related to the amount of (light) energy in the beam.
Some of this energy gets absorbed and/or scattered by the dust particles.
The further the beam travels, the more light energy is lost.**

10. How could you make the beam invisible?

Have the beam travel through a gas that is completely free of dust / suspended particles. And / or have the beam travel through a vacuum.