The Black Box

Apparatus

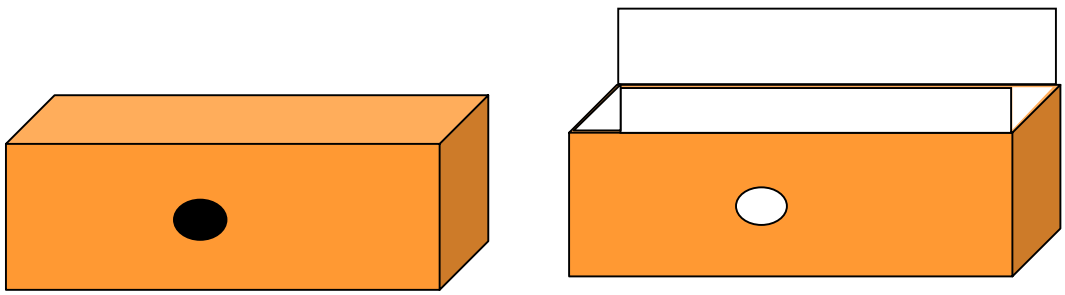
sturdy box, painted white inside, with a well-sealing lid and a small hole drilled in the side (a few mm diameter)

Action

The students look into the box and try to say what colour it is inside. They then open the box and see. They should explain why the box appears to be black inside, and relate this to the definition of a blackbody as a perfect absorber.

The Physics

When you look into the hole you see blackness, even though the inside of the box is white. This is because the hole is very small, and no light can get out of it to your eye. Black is an absence of light, and as there is no light in the box it appears black, just as a window to an unlit room is black regardless of the colours of the room. When the box is open light is reflected and you can see that it is white inside. A cavity or box with a small hole is a good approximation to a black-body because all light entering the hole is trapped, so the absorption is very high.



Accompanying sheet

The Black Box

Look into the hole. What colour do you see?
Now open the lid. What colour is the inside of the box?

Why is it so? How can you explain your observation?

How good an approximation to a perfect black body is the hole in this box?