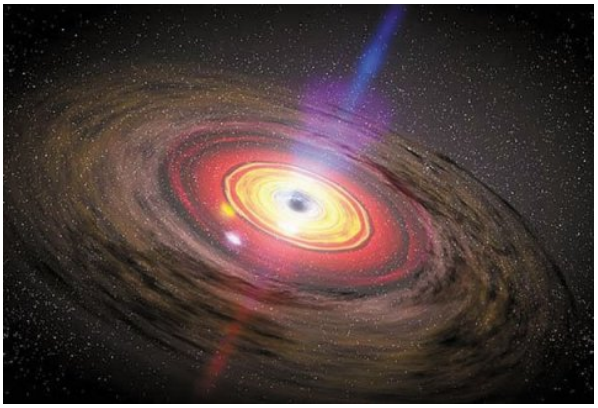
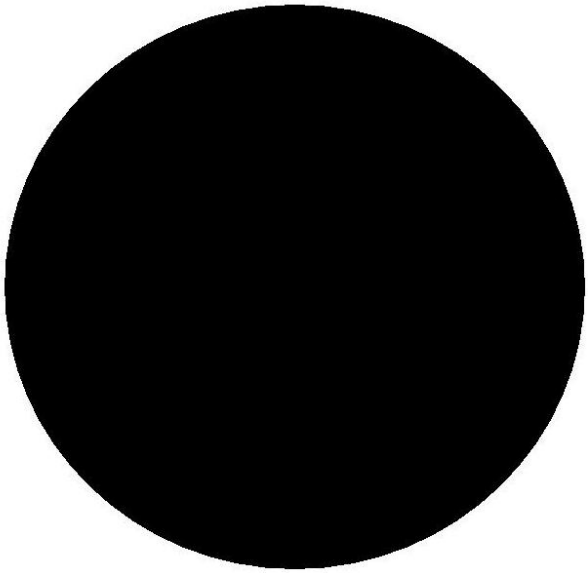


Artist's impression of gas falling into a black hole
Image credit: NASA / Dana Berry, SkyWorks Digital

When gas flows into a black hole, it gets very hot and emits light. The gas is heated because the atoms collide with each other as they fall into the black hole. Far away from the black hole, the atoms do not travel very fast so the gas is cool. But close to the black hole, the atoms can be moving at millions of kilometers/hour and the gas can be thousands of degrees hot!

The circle below represents the spherical shape of a black hole with a mass of about 5 times our Earth. Its diameter is 9 centimeters.



The formula that gives the gas temperature, T in Kelvins, at a distance of R in meters from the center of the black hole, is given by:

$$T = \frac{35,000}{R^{\frac{3}{4}}}$$

Problem 1 - Sketch a life-sized illustration of the gas surrounding the above black hole and give the temperature at a distance of 1 meter, 50 centimeters and 5 centimeters from the center of the black hole.

Problem 1 - Sketch a life-sized illustration of the gas surrounding the above black hole and give the temperature at a distance of 1 meter, 50 centimeters and 5 centimeters from the center of the black hole.

Answer: At 1 meter, **T = 35,000 K,** which is 6 times the surface temperature of our sun.
At 50 cm or 0.5 meters, **T = 59,000 K**.
At 5 centimeters or 0.05 meters, **T = 331,000 K**.

Students may color many different versions, but they should all show that the most distant gas is cooler (35,000 K) than the gas near the black hole (331,000 K) which could be temperature coded using some plausible scheme like the 'yellow to white' scheme below.