

## Astronomy 102: Assignment 4, star death and black holes

1. Calculate the escape velocity of Saturn (the mass of Saturn is  $5.7 \times 10^{26}$  kg and its radius is 60,330 km). The radius of a black hole's event horizon (the Schwarzschild radius) is directly proportional to the mass of the black hole. If the Schwarzschild radius of a 1 solar mass black hole is 3 km, what is the Schwarzschild radius of a 10 solar mass star? What is the Schwarzschild radius of Saturn which has about 1/3500 of the mass of the sun? [6]
2. Use the internet to find a planetary nebula that has not been discussed in the lectures. Write down 3 properties of that particular nebula (e.g. size, distance, age etc.). Include the website(s) that you used to get this information. Over what stellar mass range do PN occur? [6]
3. Describe the 2 types of supernovae: how do they appear different in our observations and how do we believe that each type is formed? [6]
4. Describe briefly the 3 tests of general relativity.[6]
5. What is the approximate size (radius in km) of the following objects: white dwarf, neutron star, 1 solar mass black hole. [6]

Total: 30.