

SECTION 12.1 ASSESSMENT, p. 443**Check Your Understanding Answers****Checking Concepts**

1. Edwin Hubble estimated the distance to 46 galaxies and discovered a red shift in the spectra of galaxies, meaning that all galaxies were moving away from each other, and the speed at which they were moving apart varied depending on their distances from one another. He determined that it appeared that the galaxies started moving from the same area in space.
2. Electromagnetic radiation
3. A spectroscope is an optical instrument that acts like a prism to separate light into its basic component colours.
4. The red-shifting of the galaxies' spectra indicates that the distant galaxies are moving away from us. The cosmological red shift suggests that space itself is expanding and is evidence for the Big Bang theory.

5. The Big Bang theory states that the universe began 13.7 billion years ago. The universe started as an unimaginably tiny volume of space suddenly and rapidly expanded to immense size. In a very short time, all the matter and energy in the universe was formed.
6. The cosmic background radiation, which is the radiation left over from the Big Bang expansion
7. The temperature of the Big Bang was over 1 billion degrees Celsius but has cooled since then.
8. A nebula is a cloud of hydrogen gas and dust in-between the stars in a galaxy.
9. The gas and dust in the centre of the proto-planetary disc begin to collect, building up into bigger, rocky lumps called planetesimals. These planetesimals may develop into full-fledged planets.

10. The inner planets are relatively small and have solid cores and rocky crusts. The outer planets have large gaseous bands and cold temperatures.
11. A light year is the distance light travels in one year (9.5 trillion km)

Understanding Key Ideas

15. Hubble noted that the speed at which all galaxies were moving apart varied depending on the galaxies' distance from each other. Since it appeared that they had all started moving from the same area in space, he deduced that the universe was expanding.
16. As the raisin bread bakes, it expands and the raisins move away from each other.
17. (a) The Big Bang theory states that universe will continue to expand forever. This is an open universe.
(b) The Oscillating Theory states that the universe will go through a series of Big Bangs and Big Crunches in an ongoing cycle. This is a closed universe.