12 Astronomers often use the unit megaparsec (Mpc) for astronomical distances. In a textbook a value for the Hubble constant is given as $72\,\text{km}\,\text{s}^{-1}\,\text{Mpc}^{-1}$.

(a) (i) Show that $72\,\text{km}\,\text{s}^{-1}\,\text{Mpc}^{-1}$ is equivalent to a Hubble constant of about $2.3 \times 10^{-18}\,\text{s}^{-1}$.

$1\,\text{Mpc} = 3.09 \times 10^{22}\,\text{m}$

(2)

(ii) Determine a value for the age of the universe in years.

$1\text{ year} = 3.16 \times 10^{7}\,\text{s}$

(2)

Age of universe = ... years

(b) In the 1950s, astronomers realised that they had made an error in their determination of distances to galaxies. Galaxies are twice as far away as astronomers had previously thought.

Explain how this changed the age of the universe as calculated by astronomers.

(2)

(Total for Question 12 = 6 marks)