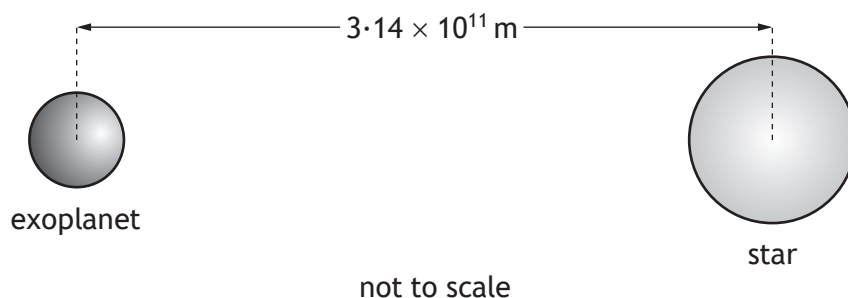


5. Planets outside our solar system are called exoplanets.

An exoplanet of mass 5.69×10^{27} kg orbits a star of mass 3.83×10^{30} kg.



- (a) (i) Compare the mass of the star with the mass of the exoplanet in terms of orders of magnitude.

2

Space for working and answer

- (ii) The distance between the exoplanet and the star is 3.14×10^{11} m.
Calculate the gravitational force between the star and the exoplanet.

3

Space for working and answer



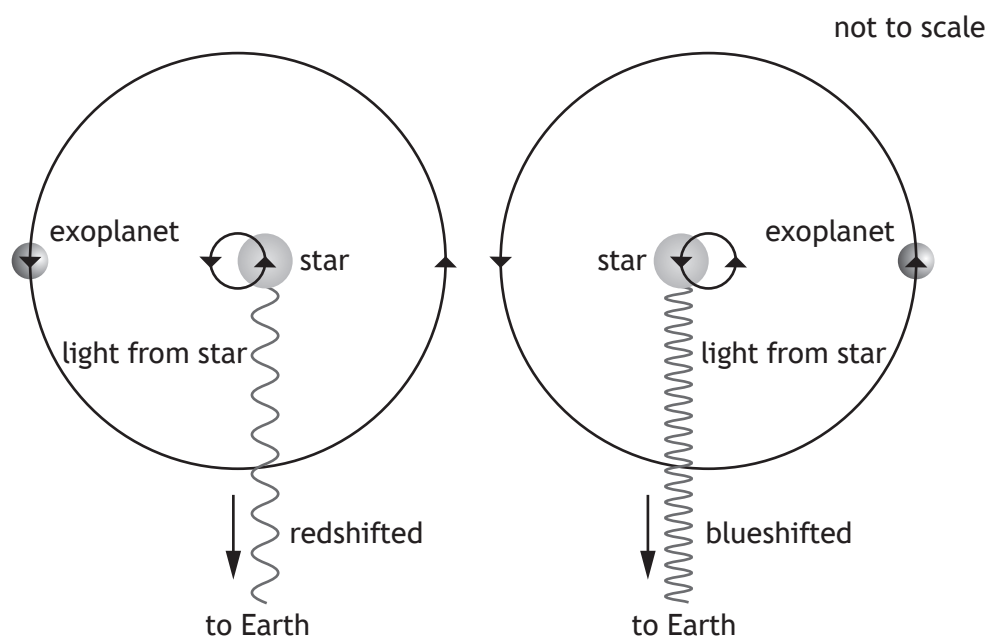
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5. (continued)

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- (b) The gravitational force between the star and the exoplanet causes the star to follow a circular path as the exoplanet orbits the star. Small differences in the wavelength of the light from the star are observed on Earth.

Light from the star is redshifted when the star moves away from the Earth and blueshifted when the star moves towards the Earth.



- (i) Calculate the redshift of light from the star observed on Earth when the star is moving away from the Earth at $6.60 \times 10^3 \text{ m s}^{-1}$.

3

Space for working and answer

- (ii) For an exoplanet of greater mass at the same distance from the star, suggest whether the radius of the circular path followed by the star would be greater than, less than, or the same as that for an exoplanet of smaller mass.

1



* X 7 5 7 7 6 0 1 1 5 *