**Name of the Student**:_____

**Max**. **Marks : 21 Marks**                                        **Time : 21 Minutes**

Q1.

State **two** advantages of using a camera, rather than the unaided eye, for studying stars.

(2)

1

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2

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Q2.

**Answer the question with a cross in the box you think is correct ⊠ . If you change your mind about an answer, put a line through the box ⊠ and then mark your new answer with a cross ⊠ .**

The Asteroid Belt is part of our Solar System.

Vesta is an asteroid in the Asteroid Belt.

Vesta orbits the Sun between the orbits of

(1)

☐ **A**    Venus and Earth

☐ **B**    Earth and Mars

☐ **C**    Mars and Jupiter

☐ **D**    Jupiter and Saturn

**(Total for question = 1 mark)**

Q3.

(i) A long time ago, scientists believed that the Earth was at the centre of the Solar System.

Evidence has since proved that the Sun is at the centre of the Solar System.
State **one other** idea about the Solar System that **has** changed over time.

(1)

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(ii) Figure 4 shows data for some of the planets of the Solar System.
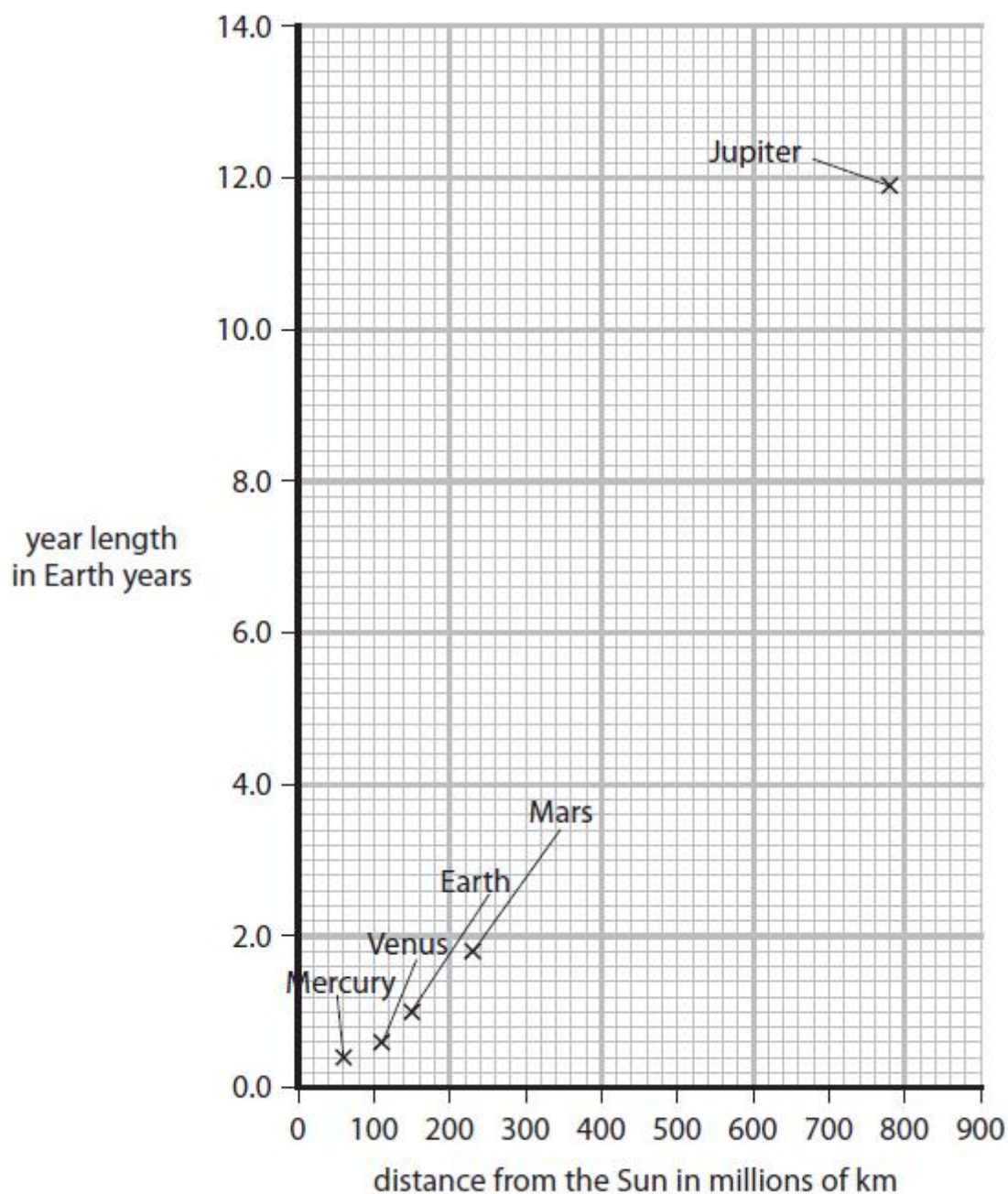


**Figure 4**

Ceres is an asteroid that orbits the Sun between Mars and Jupiter.
It takes Ceres 4.6 Earth years to make one orbit of the Sun.
Use the graph to estimate the distance of Ceres from the Sun.

Show your working.

distance of Ceres from the Sun = ............................................................. millions of km

**(Total for question = 4 marks)**

Q4.

Satellites are used to gather data about the origin of the Universe.

The Big Bang theory is a theory about the origin of the Universe.

Evidence for the Big Bang theory is provided by red-shift and CMB radiation.

(i)  Describe what is meant by red-shift.

**(2)**

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(ii)  Explain how red-shift provides evidence for the Big Bang theory.

**(2)**

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(iii)  The Cosmic Background Explorer (COBE) satellite observed CMB radiation from 1989 to 1993.

State what the 'M' in CMB radiation stands for.

**(1)**

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(iv)  State what is meant by 'cosmic background radiation'.

**(1)**

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(v)  Explain how the presence of CMB radiation provides evidence for the Big Bang theory.

**(2)**

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**(Total for question = 8 marks)**

Q5.

Figure 7 shows two hydrogen spectra.

One spectrum is taken from a source on Earth.

The other spectrum is taken from a source on a distant galaxy.

The spectral lines in the spectrum from the distant galaxy are shifted towards the red end of the spectrum.
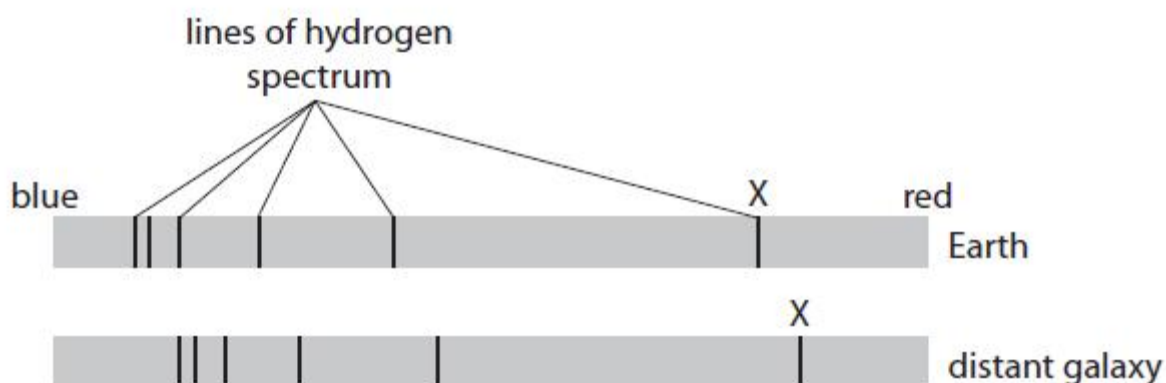
lines of hydrogen
spectrum

blue
X
red
Earth

X

distant galaxy

**Figure 7**

The wavelength of line X on Earth, $\lambda_o = 6.56 \times 10^{-7}$ m

The wavelength of line X from the distant galaxy, $\lambda_g = 6.72 \times 10^{-7}$ m

The red shift ($z$) is given by the equation

$$z = \frac{(\lambda_g - \lambda_o)}{\lambda_o}$$

(i)  Show that the red shift for the light from the distant galaxy is about 0.025

(2)

(ii)  The galaxy is moving away from the Earth at velocity, $v$ (recession velocity).

The velocity of light, $c = 3.00 \times 10^8$ m/s
The recession velocity is given by the equation.

$$v = z \times c$$

Calculate the recession velocity of the distant galaxy.

(2)

recession velocity = ........................................................... m/s

(iii) The wavelength of the spectral line X measured for a more distant galaxy was 6.92 x 10$^{-7}$ m.

Explain how this provides evidence that the Universe is expanding.

**(2)**

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**(Total for question = 6 marks)**