# 3.5 Space Physics: 10-minute Pack

Calculator allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** This question has two parts.

**(a)** Explain what a light year is. **(1)**

**(b)** Calculate how many kilometres are in 0.5 light years. Use 1 light year = 9.46 x $10^{12}$ km. **(2)**

**2** A small satellite is in low Earth orbit at 300 km altitude. The period of the orbit is about 90 minutes. Calculate the number of orbits the satellite completes in one 24-hour Earth day. Give your answer to the nearest whole number.

**(3)**


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**3** A simplified model shows Earth and Moon as point masses. A small satellite is placed halfway between Earth and Moon and is stationary relative to them. Explain whether this position is stable and name the general region where gravitational forces cancel approximately.

**(2)**

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**4** Which planet is known as the Red Planet? Choose one and give a reason for its name.

- [ ] A) Venus
- [ ] B) Mars
- [ ] C) Jupiter
- [ ] D) Mercury


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# Mark scheme · 3.5 Space Physics: 10-minute Pack

## Question 1

| | |
|---|---|
| (a) distance that light travels in one year cao | **B1** |

(a) Answer: **A light year is the distance that light travels in one year.**

| | |
|---|---|
| (b) 0.5 x 9.46 x $10^{12}$ km | **M1** |
| (b) 4.73 x $10^{12}$ km cao | **A1** |

(b) Answer: **4.73e12 km**

## Question 2

| | |
|---|---|
| calculate number = 24 hours x 60 minutes / 90 minutes | **M1** |
| 16 orbits cao | **A1** |
| units or statement 'orbits per day' (implicit) or rounding shown | **B1** |

Answer: **16 orbits per day**

## Question 3

| | |
|---|---|
| the halfway position is not stable: it is not even an equilibrium, because the Earth is about 81 times more massive than the Moon so its pull is far stronger at halfway, the forces do not cancel and the satellite would move towards the Earth (accept any answer that says it is not stable because the pulls are unbalanced or small disturbances move it away), oe | **B1** |
| name region as a Lagrange point region or specifically between Earth and Moon the neutral point, which is much closer to the Moon than halfway (about 90 percent of the way from Earth); accept L1 region or equilibrium point, oe | **B1** |

Answer: **The halfway point is not stable: Earth is about 81 times more massive than the Moon, so at halfway its pull is far stronger, the forces do not cancel and the satellite moves towards Earth. The forces cancel much nearer the Moon (about 90 percent of the way from Earth), near the Lagrange point L1 or gravitational neutral point.**

## Question 4

| | |
|---|---|
| B cao | **B1** |
| Mars is called the Red Planet because of its reddish surface, oe | **B1** |

Answer: **B) Mars**


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