

**A Level Physics A**  
**H556/01** Modelling physics

**Question Set 28**

- 1 (a)\* In 2017, an ultra-cool star TRAPPIST-1 was discovered with at least five of its own orbiting planets. Astronomers are interested about the possibility of finding life on some of the planets orbiting TRAPPIST-1.

The table below shows some data.

	TRAPPIST-1	Sun
Luminosity $L/W$	$2.0 \times 10^{23}$	$3.8 \times 10^{26}$
Surface temperature $T/K$	2500	5800
Radius of star/m	$R$	$7.0 \times 10^8$
Distance between Earth and Sun/m		$1.5 \times 10^{11}$
Distance between planets and TRAPPIST-1/m	$1.6 \times 10^9$ to $9.0 \times 10^9$	

The temperature  $T$  in kelvin of a planet, its distance  $d$  from the star and the luminosity  $L$  of the star are related by the expression

$$\frac{T^4 d^2}{L} = \text{constant.}$$

- The average temperature of the Earth is about 290K. Explain how life may be possible on some of the planets orbiting TRAPPIST-1.
- Use your knowledge of luminosity to show that the radius  $R$  of TRAPPIST-1 is smaller than the Sun.
- Support your answers by calculations.

[6]

- (b) Kepler's third law can be applied to a satellite in a geostationary orbit around the Earth.

- (i) Complete the equation for Kepler's third law below.  
You do not need to define any of the terms.

$$\dots\dots\dots = \frac{4\pi^2}{GM} \dots\dots\dots$$

[1]

- (ii) The mass of Earth is  $6.0 \times 10^{24}$  kg.  
Calculate the radius of the circular path of a satellite in a geostationary orbit around the Earth.

radius = ..... m [2]

**Total Marks for Question Set 28: 9**

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