38 The Earth, sun and moon

38.1

Using your knowledge of astronomy, state:

(a) The time between a full moon and a new moon

(b) The time that it takes for the moon to make a revolution of the Earth

(c) The time that it takes for the Earth to make a complete revolution of the sun

(d) The time that it takes for the Earth to rotate once on its axis

38.2

Using a labelled diagram, explain how the seasons occur in Ireland.

38.3

Scientists live on the International Space Station. Outline three dangers that they face and how the risk of these dangers is minimised.

(a) _____

(b) _____

(c) _____

38.4

Write down your age.

(a) How many times have you travelled around the sun?

_____

(b) How many times have you rotated with the Earth?

_____

38.5

The Earth has only one moon. Carry out research into any other moon in the solar system, stating the planet it orbits, the time it takes to orbit that planet and two other interesting facts about it.

_____

_____

_____

_____

38.6

The image below shows a planet passing in front of a star. This partial eclipse is called a transit. The brightness of the light detected from the star decreases as the planet transits the star and blocks its light.

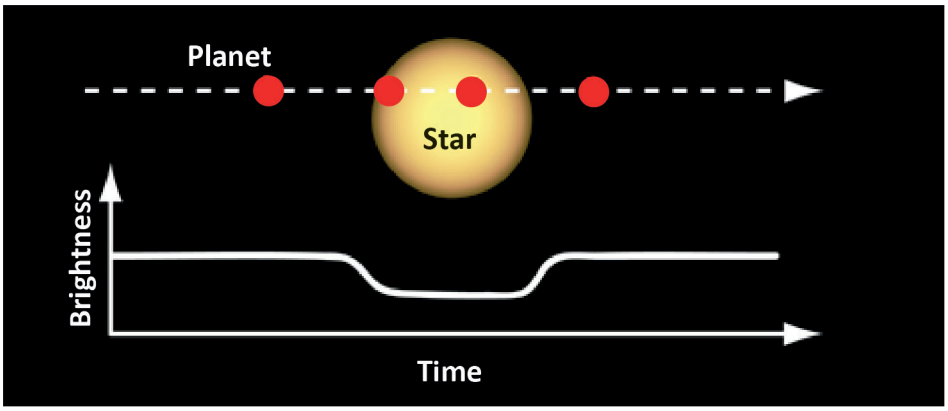

Figure 38.1

The graphs below show how the brightness of a star changed over time as two planets, **A** and **B**, transited the same star.

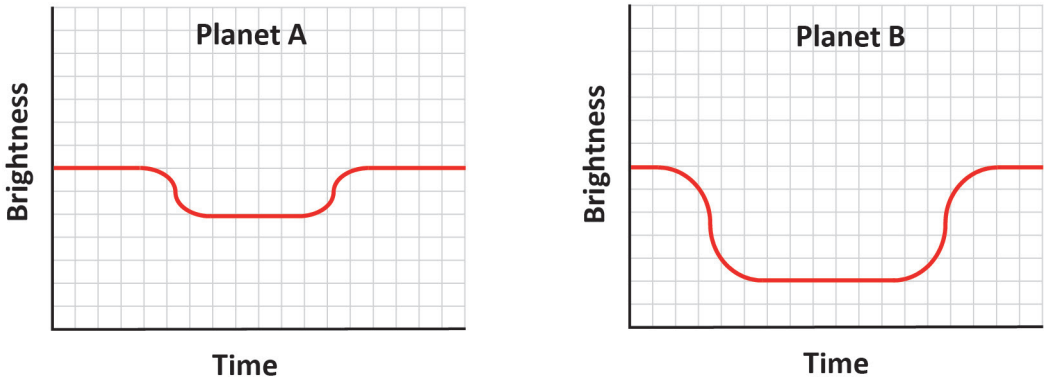

Figure 38.2

(a) Which planet, **A** or **B**, took the shortest time to transit the star?

(b) Which planet, **A** or **B**, is the largest? Give a reason for your answer.

Many investigations were carried out during missions to the Moon. One investigation measured the temperature of the lunar surface at various depths. The graph shows the temperatures measured at different depths over a period of time.

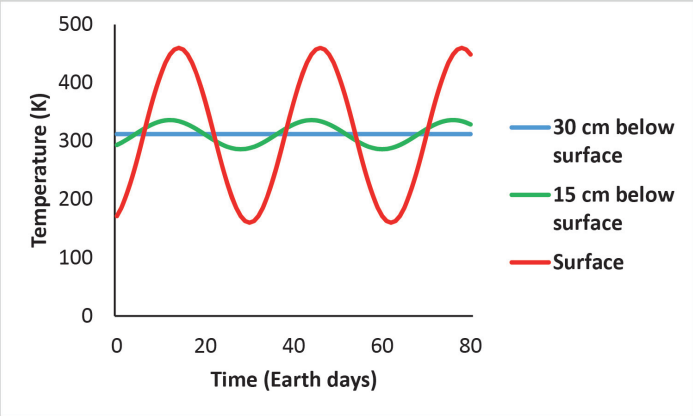

Figure 38.3

(c) Describe how the temperature on the surface of the moon (red line) changed with time. Suggest an explanation for this pattern.

(d) Describe the relationship between the depth below the surface of the moon and the change in temperature. Suggest an explanation for this relationship.

(SEC 2019 JC Science exam paper)

38.7

The Pleiades is the star of the November sky with a partial lunar eclipse at month's end

The beautiful star nursery gives its name to a famous brand of Japanese cars

Chances are you will come across a few products during the month that are named after a celestial object. One noticeable brand is Subaru cars. Their badge consists of six stars, with one now more prominent, and is the insignia adopted by a conglomeration established by six Japanese manufacturers in the 1950s. Subaru also just happens to be the Japanese name for the Pleiades star cluster in Taurus.

The cluster is roughly 115 million years old and lies about 445 light years away, so the light we see this month started its journey just before Galileo was the first to sketch the Pleiades through a telescope in the winter of 1609–10. A drawing in his great work *Siderius Nuncius* shows a couple of dozen stars.

Last quarter moon falls on November 8th, the new moon on the 15th and first quarter on the 22nd, with full moon on the 30th coinciding with a partial penumbral lunar eclipse.

These types of eclipses are more subtle, as the moon only dips into the more diffuse outer parts of Earth's shadow cast in space. The eclipse commences at 7.32 a.m. on the morning of the 30th, but you will not notice anything until close to moonset at 8.12 a.m.

A new launch date for the next Crew Dragon mission to the International Space Station is now slated to lift off on November 11th and will ferry four additional members of the latest Expedition crew to the station. Morning passes of the ISS run until November 9th, after which it switches to the evening sky from the 20th. Predictions for your location can be calculated on Heavens Above.

Chang'e, named for the Chinese Moon goddess, is China's lunar exploration series that first began in 2007, when Chang'e 1 reached lunar orbit. Chang'e 5 is a robotic sample return mission that is scheduled to launch at the end of November. Current plans are to collect about 2 kg of material from below the Moon's surface for later return to Earth.

Irish Times, 7 November 2020 (abridged)

(a) What type of celestial body is Pleiades? _____

(b) What characteristic of a celestial body such as Pleiades makes it different from other celestial bodies?

_____

(c) Telescopes are often described as time machines.

(i) Why has it taken so long for the light from Pleiades to arrive at the Earth?

_____

(ii) Looking at light from distant galaxies gives scientists information on how our solar system was created. Explain why this is so. _____

_____

(d) The article gives some information on the phases of the moon in a particular year. Draw the appearance of the moon on 22 November.

(e) Using a diagram of the Earth, sun and moon, explain how a total lunar eclipse happens.

(f) The International Space Station (ISS) has been responsible for many discoveries in science. Astronauts have to consider some hazards for their journey to and from the ISS and while aboard.

(i) Identify some hazards that the current astronauts face.

(ii) Can you think of additional hazards that astronauts participating on a mission to Mars might face?

(iii) Carry out research and give a brief account of any discoveries made aboard the ISS.

(g) Find out what research China plans to do as part of the Chang'e moon programme.

Multiple Choice questions on this chapter

1 The moon's surface is visible to an observer on Earth because the moon:

- **(a)** Reflects sunlight
- **(b)** Absorbs light from Earth
- **(c)** Produces its own light
- **(d)** Transmits sunlight

Answer: _____

2 Which event is caused by the moon passing through Earth's shadow?

- **(a)** A meteor shower
- **(b)** An eclipse
- **(c)** A change of seasons
- **(d)** An earthquake

Answer: _____

3 The length of one year is equivalent to the time it takes for one:

- **(a)** Rotation of Earth
- **(b)** Rotation of the sun
- **(c)** Revolution of Earth around the sun
- **(d)** Revolution of the sun around Earth

Answer: _____

4 What is one factor that contributes to seasons occurring in Ireland?

- **(a)** The revolution of the moon around Earth
- **(b)** The tilt of Earth on its axis
- **(c)** The rising and falling of ocean tides
- **(d)** The distance of Earth from the sun

Answer: _____

5 During which phase does the moon receive sunlight only on the side facing away from Earth?

- **(a)** Full moon
- **(b)** New moon
- **(c)** Waning gibbous
- **(d)** Waxing gibbous

Answer: _____

6 A star and all of the objects that orbit it is called a:

- Moon ☐
- Solar system ☐
- Galaxy ☐

7 A system of billions of stars is called a:

- Moon ☐
- Solar system ☐
- Galaxy ☐

8 Lunar eclipses can only occur:

- During a new moon ☐
- During a full moon ☐
- During a waxing gibbous ☐
- At any phase of the moon ☐

9 During a lunar eclipse, Earth blocks out:

- The moon ☐
- The sun ☐
- Both moon and sun ☐
- Either moon or sun ☐

10 When the sun is entirely or partially blocked out by the moon, it is termed:

- A solar eclipse ☐
- A lunar eclipse ☐
- A solstice eclipse ☐
- An equinox eclipse ☐

Acknowledgements
p. 3 © Earthsky.org