Experiment worksheet answers

6.1 The universe was studied by early Australians

Pages 140–141 and 215

Skills lab 6.1: Using a star chart

Student answers will vary.

Experiment worksheet answers

6.1 The universe was studied by early Australians

Pages 140–141 and 215

Challenge 6.1: Modern-day Australian astronomers

Student answers to questions may vary, but sample answers have been provided below.

Penny Sackett

• Conducted major research into extrasolar planets. (What are these?)

Also known as ‘exoplanets’, extrasolar planets are planets that orbit stars that are not our Sun.

• Served on the Board of Directors of the Giant Magellan project. (What is this?)

The Giant Magellan project is the construction of a ground-based telescope that, once completed, will be the largest optical observatory in the world. It will be constructed in the Las Campanas Observatory in Chile.

• Has worked as a science reporter for *Science News*.

• Born in 1956 in the USA.

• Worked as Director of the ANU Research School of Astronomy and Astrophysics. (When?)

Sackett was Director of the ANU Research School of Astronomy and Astrophysics from 2002 until 2007.

• Appointed as the Chief Scientist of Australia. (When?)

Sackett was appointed Chief Scientist of Australia from November 2008 until March 2011.

Brian Schmidt

• Headed the SkyMapper project. (What is this?)

The SkyMapper project is the construction of an automated wide-field survey telescope with a mission to robotically create the first comprehensive digital survey of the entire southern sky. This information will then be freely accessible via the internet.

• Was a member of the High-Z SN search team. (What did this team do?)

The High-Z SN search team was an international collaboration to use Type 1a supernovae to chart the expansion of the universe.

• Born in 1967 in the USA.

• Made a major scientific breakthrough in 1998. (What was it?)

As a member of the High-Z SN search team, was the first to publish evidence that the expansion of the Universe is accelerating rather than decelerating as previously thought.

• Worked mainly with exploding stars called supernovas.

• Been jointly awarded the US$1 million Shaw prize for astronomy. (When and why?)

Schmidt was jointly awarded the Shaw prize in 2006 as well as the 2011 Nobel Prize in Physics for his work on the 1998 breakthrough mentioned previously.

Experiment worksheet answers

6.2 The Earth is in the Milky Way

Pages 142–143 and 216

Challenge 6.2: Understanding parallax

Discussion

1 Why do most members of the class see a different alignment of the student and the numbers on the whiteboard?

The line of sight for students on the right-hand side of the room is different to students on the left-hand side of the room. This is called parallax.

2 Relate this activity to the night sky. What do the numbers represent? What does the student represent? What do the members of the class represent?

The number represents the stars that are further away from Earth. The student represents stars that are closer to Earth. The members of the class are the different observation points on the Earth.

3 How would the results of this demonstration be different if the student stood approximately 30 cm in front of the whiteboard?

If the student moves closer to the whiteboard, the differences from parallax will be less than if the student moves away from the whiteboard.

Experiment worksheet answers

6.2 The Earth is in the Milky Way

Pages 142–143 and 217

Experiment 6.2: Calculating the distance to the Sun

Discussion

1 The correct value for the distance to the Sun is approximately 149 600 000 km. Work out the difference between LS and this value. Call this value the difference.

Students’ own values.

2 Divide the difference by the correct value and multiply by 100. This converts it to a percentage and is called the percentage error. Round it off to the nearest whole number.

Students’ own values.

3 What factors contributed to this error? (Hint: Which measurements were not exact?)

There are two measurement errors in the distances between the lines and the distances between the sheets, and one rounding error in the acceptance of the distance to the Sun as 149 600 000 km (which is only an approximated average).

Conclusion

Write a conclusion for this experiment that relates the findings to the aim. Mention the size of the percentage error and comment about how the experiment could have been modified to reduce the errors.

The value of the distance to the Sun is not very accurate as there were many errors. The main errors were attributed to measurement error, precision of drawing the parallel lines, precision of setting up the screens at the correct locations and the precision of the measuring devices.

Experiment worksheet answers

6.4 The galaxies are moving apart

Pages 146–147 and 218

Challenge 6.4: Exploring the Doppler effect

Discussion

1 What happens to the pitch of the sound as the Doppler effect apparatus spins around?

The pitch varies from high to low.

2 When is the pitch higher? When is it lower?

The wave is higher pitched when moving towards the students and lower pitched when moving away from the students.

3 Relate this demonstration to the red shift and blue shift that are seen with starlight.

As a light wave is emitted when the source is moving away from you, the pitch (frequency) will be lower so it will appear as a colour nearer the red end of the visible spectrum. As a light wave is emitted when the source is moving towards you, the pitch (frequency) will be higher so it will appear as a colour nearer the blue end of the visible spectrum.

Note that when students twirl the sound source above their heads they will hear a constant tone, but the class will hear the high-pitched sound and then the low-pitched sound. This is because the sound source has a constant relative movement.

Experiment worksheet answers

6.4 The galaxies are moving apart

Pages 146–147 and 218

Experiment 6.4: Investigating emission spectra

Discussion

1 Each element has a distinct emission spectrum. How is this used to identify the elements present in the universe?

The light emitted from stars can be analysed as an emission spectrum and the patterns observed can be used to deduce the elements contained in such stars.

2 If the light from a distant nebula had lines missing from its spectrum, what would that mean?

If the light from a distant nebula had lines missing, this would mean that gases between the nebula and the observation point had absorbed some of the light. These gases may have been in our atmosphere or within the nebula.

Conclusion

How does the light emitted from different elements vary?

Each element produces a uniquely different emission spectrum, which allows them to be identified.

Experiment worksheet answers

6.5 The Big Bang theory is supported by evidence.

Pages 148–149 and 219

Challenge 6.5: The expanding universe

Discussion

1 How far has each cross moved?

Student’s results will vary depending on how much air is in the balloon.

2 Predict what would happen to the distance between the crosses if you added more air into the balloon.

The crosses would move further apart.

3 Relate the movement of the crosses to the expansion of the universe.

As the balloon expands, the crosses move further apart. As the universe expands, the galaxies move further apart.