Physics – an introduction
Answer key and audioscript

A - Vocabulary
1. A 2. B 3. C 4. B

B - Comprehension
1. D 2. A 3. F 4. B 5. E

C - Listening
Man: And now we bring you our weekly *Potted history of a famous person.*

Woman: Nicolaus Copernicus (1473 – 1543) a Polish astronomer, provided the first modern theory of a heliocentric, that is sun-centred, solar system.

Nowadays we might find it hard to believe anything different from the idea that the Earth travels round the sun, but in Copernicus' day, a time when people were sure the Earth had to be the most important planet, as it had been created by God, it was believed that the sun went round the Earth.

Copernicus held many important positions and studied in many fields, including maths and astronomy. Obviously a great man, he came up with perhaps one of the most important scientific hypotheses in history. Moreover, his ideas led the way for scientists to question theories already held. He called into question Aristotle's view that knowledge came from what we understood with our senses. Copernicus argued that a scientific law need not be overly concerned with appearance. This concept brought about a scientific revolution. So let us consider more carefully what Copernicus was hypothesizing in his heliocentric theory. Well, there were seven parts to his theory. These were:

Firstly, the universe does not have one centre. Secondly, the Earth is not the centre of the universe. Thirdly, any centre of the universe is near the Sun. Fourthly, the distance from the Earth to the sun is nothing if you compare it to the distance from the Earth to the stars. Fifthly, the fact that the Earth revolves explains why the starts also revolve. Sixthly, the apparent movement of the sun is caused by the Earth revolving around the sun and finally, the apparent backward motion of the planets is caused by the motion of the Earth, from which they are observed.

Other pieces of knowledge we now take for granted are also due to Copernicus' research: he gave the correct order of the known planets; and he showed why we have seasons. These are points we'll be looking into in next week's...

1. sun-centred
2. Earth
3. question
4. universe
5. seasons

D - Vocabulary

a) 1. H 2. D 3. B 4. E 5. C 6. G 7. F 8. A

b)

1. perform
2. three-dimensional
3. leading
4. accelerate
5. survey
6. spark
7. dark matter
8. reveal

E - Comprehension

1. F 2. F 3. T 4. T 5. F

F - Listening

Teacher: Well Jade, you've done the research for your project, the Big Bang, so let's go through what you found and I'll answer any questions you have.
Jade: Hmm, it appears that the Big Bang is a scientific theory of how the universe emerged roughly 13.7 billion years ago. The phrase Big Bang is used both to mean a point in time when the expansion of the universe began and more generally to explain the origin and expansion of the universe.
Teacher: Yes, Jade. Well done. Basically, it's an explanation for the beginning of the universe. So tell me. What did you learn about matter as far as the theory is concerned?
Jade: If I've understood correctly, the universe today is expanding because all matter is moving outwards. So if we follow the movement back in time, we come to the conclusion that at one time all matter was concentrated together.
Teacher: Precisely. And then for some reason, which has yet to be explained, it exploded and that sent all the material outwards. This then triggered a chain of events leading to the creation of the galaxies, stars, planets and the beginning of life on Earth.
Jade: Yes, and I found out that nanoseconds – that's a really short time – after the Big Bang, the whole universe was made up of a hot, thick cloud of hydrogen atoms. Because it was so dense, the atoms collided violently, which caused a lot of the hydrogen atoms to fuse together and form helium.
Teacher: Interestingly enough, that's actually what is going on at the core, that is, the centre of a star too! Anyway, once the Big Bang had occurred it took a couple of hundred million years for the hydrogen and helium to collect together into enormous gas clouds, pushed by gravity. These were the beginnings of simple galaxies. Well, time is getting on, so we'll continue this at our next meeting.

1. Roughly 13.7 billion years ago.
2. It's used to refer to a point in time when the expansion of the universe began as well as generally to explain the origin and expansion of the universe.
3. outwards
4. concentrated
5. a chain of events leading to the creation of galaxies, stars, planets, the beginning of life.
6. The universe was so dense after the Big Bang that the hydrogen atoms collided violently.

7. Hydrogen and helium came together into enormous gas clouds pushed by gravity and that was the beginning of simple galaxies.

H - Writing

Model answer

Before the scientific revolution the world was viewed very differently. To understand why, we need to first look at the reasons for thinking in the past and then explain how modern scientists changed those beliefs.
Ancient thought was guided by philosophy and religion. Rather than analyzing an idea based on what could be seen, descriptions of the world were according to what a philosopher believed. Nevertheless, there were thinkers using mathematics and observation for scientific reasons and sometimes the right answer was found to a question even if it was for the wrong reason.

Modern thought began with a scientific revolution influenced by the works from Eastern scholars in the early middle ages. Works like Galileo's on dynamics, and Newton's laws of motion all built on them, bringing in modern physics. The 19th century saw investigation into electricity and thermodynamics. Through the use of equations and investigation, theories were discovered allowing many advances in technology. Later examples included the development of X-rays and nuclear power. Physics progressed, quantum mechanics gave explanations for how particles move and the whys of the universe. Due to science developing finding proof became the key to new ideas based on what could be seen. Of course, knowing what mistakes had gone before also helped modern scientists.

Finally, we can understand that theories of physics both before and after the scientific revolution had a need for observation and proof. However, the difference lay in how easily theories were accepted, with modern thinkers requiring more analysis and proof, and also claiming to change the world.