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Activity

Practice-for-exam questions

Mary Whitehouse

Use the questions below either in class or for individual work after students have read the articles in the magazine. Some of the questions require additional data; students should either make reasonable estimates of quantities, or look up values using a data book or websites. Suggested outline answers are provided in a separate document.

The general theory of relativity

1 On page 6 the author explains why an observer sitting at the front of an accelerating spacecraft observes difference between clocks at the front and the back of the spacecraft. He then goes on to state that 'someone sitting at the top of a mountain observes a clock at the bottom of the mountain running at a slower rate than a clock beside them at the top.'

Use the equivalence principle to justify this statement.

2 The GPS system relies on the receivers on the ground 'knowing' the time at which a signal was sent from the satellite to calculate the position of the receiver. The clocks on the GPS satellites are set to tick faster than identical clocks on the ground by about 38 microseconds per day. The satellites are about 20 000 km above the surface of the Earth.

Describe and explain the cumulative error that would occur in calculating the position of the receiver if the clocks were not calibrated as described on page 6.

The photoelectric effect revisited

1 The photoelectric effect normally only occurs when visible, UV or higher frequency electromagnetic radiation falls on a metal surface. Explain why it does not occur when radio waves are used.

2 Describe and explain how you could use a gold-leaf electroscope, a block of metal (e.g. zinc) and suitable lamps to demonstrate that the photoelectric effect is due to the frequency and not the brightness of the light.

At a glance: water power

1 Show that the figures given for the Three Gorges Dam are internally consistent.

2 Estimate the contribution to world hydroelectric power that is produced by the Three Gorges scheme. Comment on your answer.

On the water

Using Figure 1 as your starting point, draw diagrams to explain why the chance of capsizing increases if you move from sitting in the middle of a boat to standing up to get out of the boat.

Our radioactive environment

1 The article states that strontium is 'chemically similar to calcium'. The human body processes strontium in a similar way to calcium, an essential element for building bones and teeth. Use your ideas about radioisotopes to explain why the release of strontium-90 into the environment is of particular concern.

2 Suggest why airlines are required to keep records of the number of hours flown by long-haul air crew.

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