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Activity

Practice-for-exam questions

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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 to questions are provided in a separate document.

Regulating the heart

- 1 Use the graph in Figure 1 to estimate the heart rate of a normal heart. Give your answer in beats per minute. Use the information in the text to confirm that your answer is reasonable.
- 2 The artificial pacemaker delivers charge in a short pulse (see the top of page 4).
 - a Calculate the maximum average current that will flow during a pulse.
 - b Explain why the current you calculated is an average current.
- 3 The ICD defibrillator is required to deliver an electric shock (page 5).
 - a Calculate the energy stored on the $100\ \mu\text{F}$ capacitor prior to discharge.
 - b Use the information in the text to check that your answer is reasonable.

Determining Jupiter's mass

- 1 The Earth's diameter is 1.274×10^3 km.
 - a Use this value and some of the data on page 10 to compare the density of the Earth with that of Jupiter.
 - b Refer to information in the text and comment on your answer.
- 2 Summarise how this article shows that observations, theories, and technologies all link together in the development of our understanding of the universe.

Measuring gravity's effect on time

- 1 The Galileo satellites each have a launch mass $m_s = 700$ kg. Use this value to calculate the change in gravitational potential energy when a satellite is raised by 3500 km from its lowest orbital height (page 12).

radius of the Earth $R_E = 6400$ km

mass of the Earth $M_E = 6.0 \times 10^{24}$ kg

2 Show that the acceleration due to gravity will approximately halve when the satellite changes height from 17000 km to 26000 km (page 13).

Bohr's theory of the atom revisited

1 Use your understanding of circular motion and electric fields, and ideas about proportionality, to explain why 'lower values of n correspond to higher values of circulating speed v_n '.

2 Show that the typical thermal kinetic energy of an atom at room temperature is about 0.025 eV.

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