Year 11 Science: Thermal energy, heating and insulation

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. How much energy is needed to heat 2.0 kg of water from 20 °C to 45 °C?

2. 9000 J of energy raises the temperature of a 0.5 kg metal block by 20 °C. Find its specific heat capacity and use the table to name the metal.

3. How much energy is needed to boil away 0.2 kg of water that is already at 100 °C?

4. 21 000 J is given to 0.25 kg of water. By how much does its temperature rise?

5. Explain why a puffer jacket keeps you warm, in terms of heat transfer.

Exam-style question: the hot water bottle

Sione fills a hot water bottle with 1.5 kg of water at 60 °C and puts it in his bed. Eight hours later the water is at 20 °C. The specific heat capacity of water is 4200 J kg^{-1} °C^{-1}.

6. Calculate the thermal energy the water gives out over the eight hours.

7. Calculate the average rate at which the bottle gives out energy, with a unit.

8. Sione's grandmother knits a thick woollen cover for the bottle. Discuss how the cover affects conduction, convection and radiation, and what this means for how long his bed stays warm.

Fix the mistake

9. Correct this statement: "Water heated from 20 °C to 70 °C: E = 0.5 × 4200 × 70."

10. Correct this statement: "Cold gets into the flask through the walls."

11. Correct this statement: "Hot air rises because heat rises."

12. Correct this statement: "While ice melts its temperature rises because energy is going in."