

CHAPTERS 9 & 10 TEST

Electricity and Energy (Advanced)

Time: 75 minutes Total Marks: 80

Instructions:

- Answer all questions
- Show working for calculations
- Use correct scientific terms and units

Section A: Knowledge & Understanding (15 marks)

1. State the difference between temperature and thermal energy. (3)

2. Explain why it takes longer to heat a cinema than a small room to the same temperature. (3)

3. a) Name the method of energy transfer in solids. (1)

b) Explain how energy is transferred by this method in metals. (3)

4. Why does shiny metal feel colder than plastic even when both are at the same temperature? (3)

Section B: Data, Tables & Calculations (25 marks)

5. It takes 4200 J to raise the temperature of 1 kg of water by 1 °C.

a) Calculate the energy needed to raise the temperature of 2 kg of water by 3 °C. (3)

b) Calculate the energy needed in kJ to raise 5 kg of water by 2 °C. (3)

6. A student investigates insulation by wrapping materials around a beaker of hot water.

| Material | Temperature drop (°C) |
|----------|-----------------------|
| Paper | 18 |
| Cotton | 12 |
| Foam | 5 |
| Wool | 15 |

a) Which material is the best insulator? Explain your answer. (3)

b) Explain why materials containing trapped air are good insulators. (3)

7. Explain why water cools more slowly than cooking oil when both are left in the same room. (4)

Section C: Energy Transfer Processes (20 marks)

8. a) Describe what happens to air particles when air is heated. (3)

b) Explain how this leads to convection currents. (3)

9. Explain why:

a) Black surfaces absorb infrared radiation better than shiny surfaces. (3)

b) Thermal imaging cameras can detect people in the dark. (3)

10. A nurse wipes ethanol on a patient's skin before an injection.

a) Explain why the skin feels cold. (4)

b) Why does ethanol cool the skin more effectively than water? (3)

Section D: Electricity & Energy Resources (20 marks)

11. a) Define electric current. (2)

b) Explain why increasing the speed of a magnet moved into a coil increases the induced voltage. (3)

12. The table shows how electricity generation changed between 1971 and 2007.

| Energy source | 1971 (%) | 2007 (%) |
|---------------|----------|----------|
| Coal | 40 | 41.5 |

| | | |
|---------|------|------|
| Oil | 20.9 | 5.6 |
| Gas | 13.3 | 20.9 |
| Nuclear | 2.1 | 13.8 |
| Hydro | 23.0 | 15.6 |

a) Which energy source increased the most? (1)

b) State one reason why oil use decreased. (2)

c) Suggest one energy source that could be classified as "other". (2)

End of Test

ANSWER KEY

Section A

1. Temperature = how hot/cold; thermal energy = total energy stored (3)
2. Larger mass and more particles need more energy (3)
- 3a. Conduction (1)
- 3b. Free electrons transfer energy by collisions (3)
4. Metal conducts energy away from skin faster (3)

Section B

- 5a. $2 \times 3 \times 4200 = 25200 \text{ J}$ (3)
- 5b. 42 kJ (3)
- 6a. Foam – smallest temperature drop (3)
- 6b. Trapped air reduces conduction and convection (3)
7. Water has higher specific heat capacity (4)

Section C

- 8a. Particles move faster and spread out (3)
- 8b. Warm air rises, cool air sinks forming a current (3)
- 9a. Black surfaces absorb more radiation (3)
- 9b. People emit infrared radiation (3)
- 10a. Fast molecules escape taking energy (4)
- 10b. Ethanol evaporates faster (3)

Section D

- 11a. Rate of flow of electric charge (2)
- 11b. Faster change in magnetic field (3)
- 12a. Nuclear (1)
- 12b. Pollution / limited supply / alternatives (2)
- 12c. Wind / solar / tidal / geothermal (2)

End of Answer Key