Heat Transfer in Nature

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. Heat moves through a solid mainly by:
(a) radiation **(b)** evaporation **(c)** convection **(d)** conduction

2. Which of these is a GOOD conductor of heat?
(a) aluminium **(b)** wool **(c)** porcelain **(d)** air

3. Which of these is a POOR conductor of heat?
(a) silver **(b)** copper **(c)** steel **(d)** porcelain

4. When the handle of an iron pan heats up, heat moves mainly by:
(a) radiation **(b)** evaporation **(c)** convection **(d)** conduction

5. Near the sea, which breeze blows at midnight?
(a) a land breeze, from the land to the sea **(b)** no breeze at all
(c) a breeze straight up into the sky **(d)** a sea breeze, from the sea to the land

6. Pins are fixed with wax every 2 cm along a metal strip, starting 2 cm from the heated end. 10 pins have fallen. About how far along the strip has the heat reached?
(a) 22 cm **(b)** 10 cm **(c)** 12 cm **(d)** 20 cm

7. Soil and water both start at 26 °C in the sun. After 20 minutes the soil is 35 °C and the water 29 °C. How many degrees hotter is the soil?
(a) 3 °C **(b)** 9 °C **(c)** 6 °C **(d)** 35 °C

8. In 10 minutes, 120 mL of water passed through gravel, 110 mL through sand and 30 mL through clay. How much more passed through gravel than clay?
(a) 90 mL **(b)** 150 mL **(c)** 10 mL **(d)** 80 mL

Section B — Short answer — 8 × 2 = 16 marks

9. What is conduction? Give an example.

10. Is each a "good" or "poor" conductor of heat? (a) aluminium (b) plastic

11. Name the way heat moves (conduction, convection or radiation): (a) a hot utensil cools in the air around it (b) a metal spoon in hot tea gets hot

12. Near the sea, is there a "sea breeze" or a "land breeze" (a) at night (b) at midday?

13. Soil in the sun was measured every 5 minutes: 29 °C, 33 °C, 36 °C, 40 °C, 44 °C. By how much did its temperature rise in 20 minutes?

14. A recharge pit takes in 60 litres of rainwater every hour during rain. How much water goes into the ground in 6 hours of rain?

15. Explain why: (a) wool keeps us warm (b) hollow bricks in walls

16. Tea was poured at 90 °C. After 10 minutes it was 81 °C in a clay cup and 72 °C in a steel tumbler. Which kept it hotter, and by how much? Why?

Section C — Word problems — 4 × 4 = 16 marks

17. Describe an activity to show conduction in a metal strip.

18. Soil and water were kept in the sun and their temperatures read every 5 minutes.
Soil: 30, 34, 38, 41, 44 °C
Water: 30, 30, 31, 31, 31 °C
(a) How much did each warm up? (b) Which heats faster? (c) Use this to explain why a sea breeze blows in the afternoon.

19. 200 mL of water was poured into gravel, sand and clay. In 10 minutes, 140 mL, 130 mL and 60 mL came out. (a) How much stayed in each? (b) Which lets water through fastest, and why? (c) Why does this matter for groundwater?

20. Name the way heat moves in each and explain how the particles take part: (a) we feel warm sitting near a bonfire (b) a sea breeze blows in the afternoon

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Answer key

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Q	Answer	Working
1	(d) conduction	—
2	(a) aluminium	—
3	(d) porcelain	—
4	(d) conduction	—
5	(a) a land breeze, from the land to the sea	—
6	(d) 20 cm	10 × 2 = 20
7	(c) 6 °C	35 − 29 = 6
8	(a) 90 mL	120 − 30 = 90
9	Heat passing from particle to particle in a solid, such as a metal spoon in hot tea getting hot.	—
10	(a) good (b) poor	—
11	(a) radiation (b) conduction	—
12	(a) land breeze (b) sea breeze	—
13	15 °C	44 − 29
14	360 L	60 × 6 = 360
15	(a) it traps air, a poor conductor (b) trapped air is a poor conductor	—
16	the clay cup, by 9 °C: clay is a poorer conductor of heat	81 − 72
17	Stick pins with wax about 2 cm apart along a metal strip and heat one end. The pins fall one by one, starting from the heated end, as heat passes along the strip from particle to particle.	—
18	(a) Soil: 14 °C; water: 1 °C (b) Soil (land). (c) The land gets hotter than the sea, the air over it rises, and cooler air from the sea moves in to take its place.	—
19	(a) Gravel 60 mL, sand 70 mL, clay 140 mL (b) Gravel: the gaps between its pieces are biggest. (c) Water seeps through loose soil and gravel to refill groundwater in aquifers.	—
20	(a) radiation (b) convection	—