

8.2 Thermal Energy Transfer

Question Paper

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| Course | DPIB Physics |
| Section | 8. Energy Production |
| Topic | 8.2 Thermal Energy Transfer |
| Difficulty | Medium |

Time allowed: 20
Score: /10
Percentage: /100

Question 1

Objects with absolute temperature can lose energy through

- I. convection
- II. conduction
- III. radiation

Equipment is tested on Earth for use on the surface of Mars. How will the equipment lose energy in the two locations?

| | Earth | Mars |
|----|----------------|-----------------|
| A. | I and III only | II and III only |
| B. | I, II and III | II and III only |
| C. | I and III only | I, II and III |
| D. | I, II and III | I, II and III |

[1 mark]

Question 2

The average albedo of desert sand is 0.4. What is the $\frac{\text{power absorbed by desert sand}}{\text{power reflected by desert sand}}$?

- A. 0.4
- B. 0.67
- C. 1.5
- D. 4.0

[1 mark]

Question 3

The black body temperature of Venus is 90% of the black body temperature of Earth.

Which of the following correctly shows the ratio:

$$\frac{\text{energy radiated per second per unit area on Venus}}{\text{energy radiated per second per unit area on Earth}}$$

- A. 0.7
- B. 0.9
- C. 1.0
- D. 1.5

[1 mark]

Question 4

Which factors affect the amount of solar power incident on a given point on the surface of the Earth?

- I. Weather conditions
- II. Latitude
- III. Position of the Moon in its orbit of the Earth
- IV. Position of the Earth in its orbit of the Sun

- A. I and IV only
- B. I and II only
- C. I, II and III
- D. I, II and IV

[1 mark]

Question 5

A black body has absolute temperature T and surface area A . The total power radiated by the body is P . What is the value of power if the surface area is reduced to one third of A , and the temperature increased to three times T ?

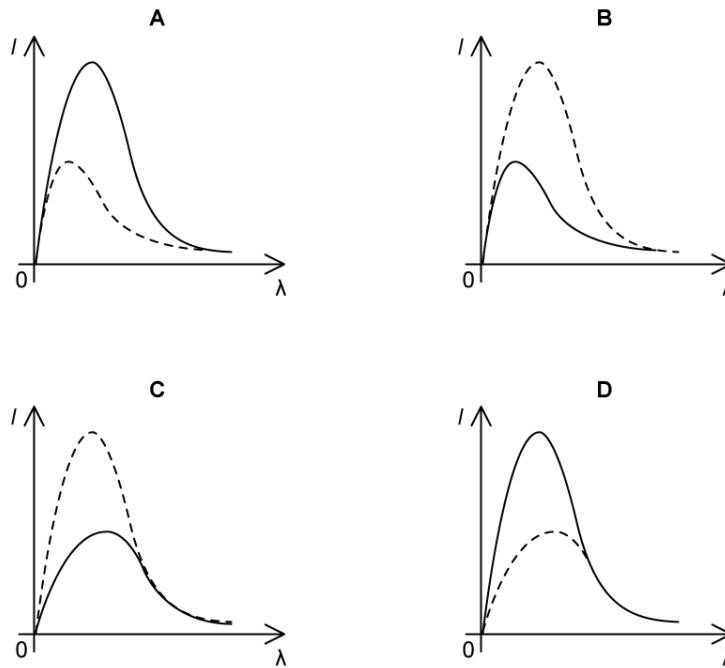
- A. P
- B. $3P$
- C. $27P$
- D. $81P$

[1 mark]

Question 6

A graph is plotted to show the variation of intensity I and wavelength of emitted radiation λ . Cool objects are represented by a dashed line, and hotter objects are represented by a solid line.

Which graph correctly shows the relationship between I and λ ?



[1 mark]

Question 7

The solar constant is quoted as an average rather than an absolute value. Which statements correctly explain this?

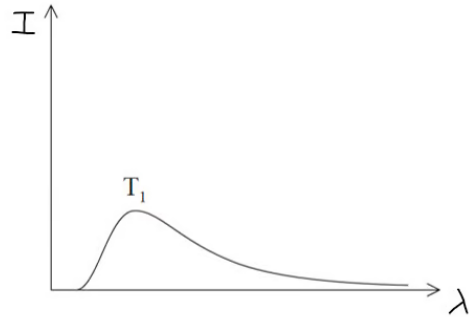
- I. The Earth follows an elliptical orbit around the Sun
- II. The Earth rotates on an axis which is tilted at 23.5° to the plane of its orbit
- III. The energy output of the Sun varies according to an 11-year cycle

- A. I only
- B. II and III only
- C. I and III only
- D. III only

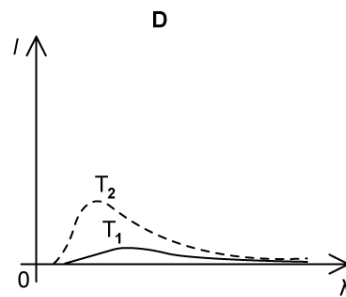
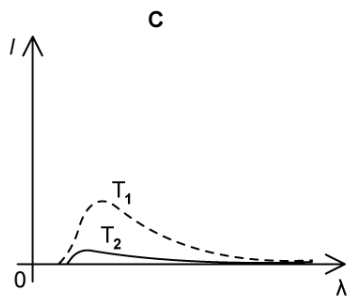
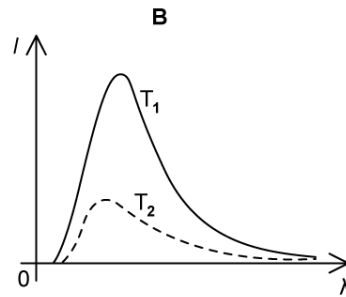
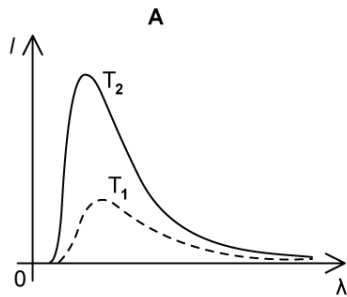
[1 mark]

Question 8

The graph shows the relationship between intensity I and wavelength λ for a black body object at absolute temperature T_1 .



Which solution correctly shows a second line representing another black body at a lower absolute temperature T_2 ?



[1 mark]

Question 9

Certain gases, for example carbon dioxide and methane, are categorised as greenhouse gases. This is because they:

- A. Transmit incoming radiation from the Sun and then absorb outgoing radiation from the Earth
- B. Absorb incoming radiation from the Sun and also absorb outgoing radiation from the Earth
- C. Reflect incoming radiation from the Sun
- D. Reflect outgoing radiation from the Earth

[1 mark]**Question 10**

Some of the energy incident on the surface of the Earth is emitted as infrared radiation. Why does this cause a 'greenhouse effect'?

- A. The radiation becomes trapped in the troposphere
- B. The radiation heats the upper atmosphere
- C. The radiation is absorbed by the atmosphere and is re-radiated in all directions
- D. The radiation is absorbed by the upper atmosphere then all re-radiated back to the surface of the Earth

[1 mark]