8.2 Thermal Energy Transfer

Question Paper

Course	DP IB 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:

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

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

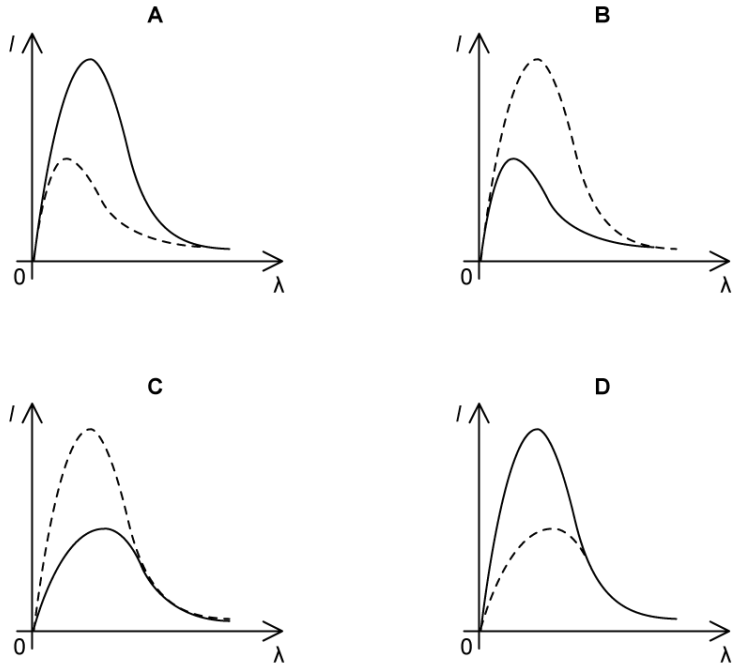
D. 81P

[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

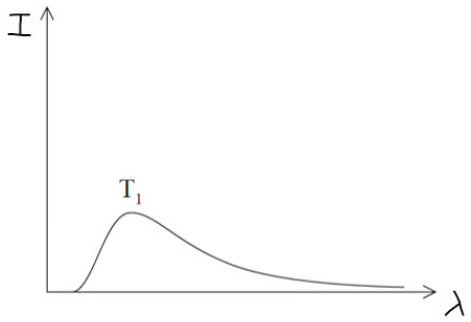
C. I and III only

D. III only

[1 mark]

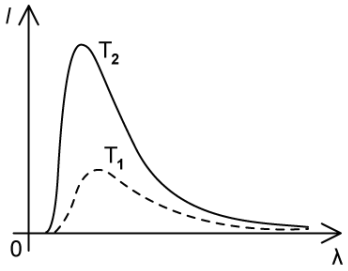
Question 8

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

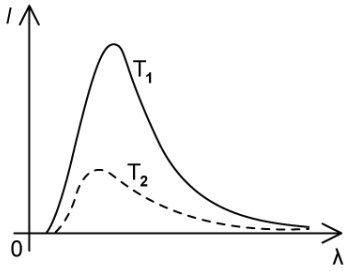


Which solution correctly shows a second line representing another black body at a lower absolute temperature T_2?

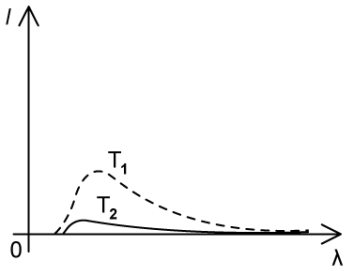
A



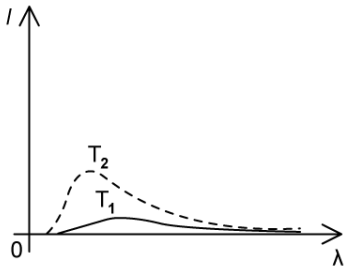
B



C



D



[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]