Question

The Sun has a radius of 7.0×10^{8}m and is a distance 1.5×10^{11} m from Earth. The surface temperature of the Sun is 5800 K.

a. Show that the intensity of the solar radiation incident on the upper atmosphere of the Earth is approximately 1400Wm^{-2}.

b. The albedo of the atmosphere is 0.30. Deduce that the average intensity over the entire surface of the Earth is 245Wm^{-2}.

c. Estimate the average surface temperature of the Earth.

Question

The average intensity of the solar radiation incident on a planet is 200 W m^{-2}. The albedo of the planet is 0.6. The average temperature of the planet is constant.

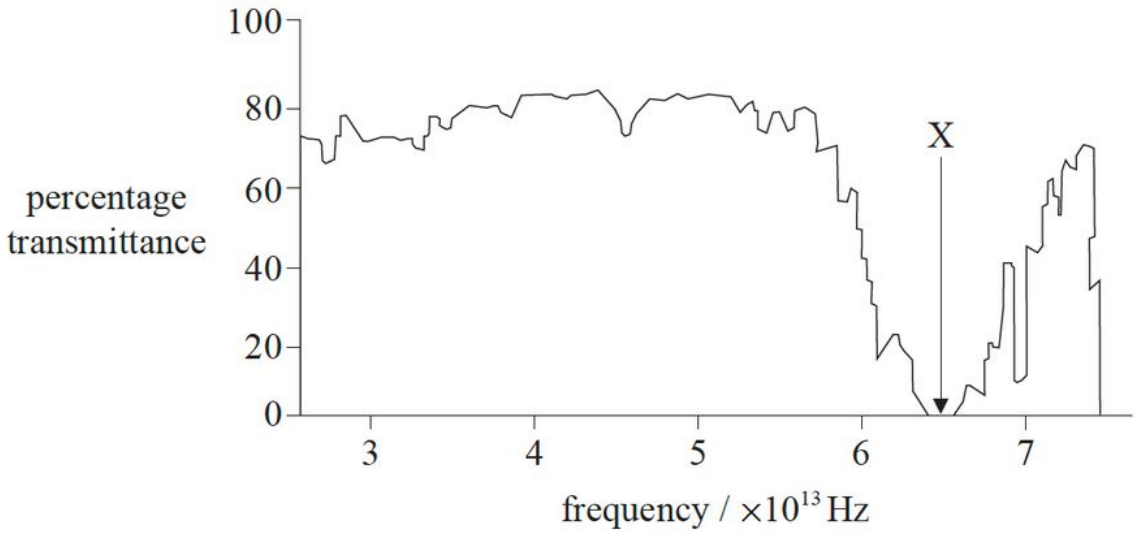
Which of the following is a correct statement about the intensity of radiation reflected and radiated by the planet?

	Intensity reflected by planet	Intensity radiated by planet
A.	$120\,\text{W m}^{-2}$	$80\,\text{W m}^{-2}$
B.	$120\,\text{W m}^{-2}$	less than $80\,\text{W m}^{-2}$
C.	$80\,\text{W m}^{-2}$	$120\,\text{W m}^{-2}$
D.	$80\,\text{W m}^{-2}$	less than $120\,\text{W m}^{-2}$

Part 1 Greenhouse effect

a. Describe what is meant by the greenhouse effect in the Earth's atmosphere. [3]

b. The graph shows the variation with frequency of the percentage transmittance of electromagnetic waves through water vapour in the atmosphere. [9]



(i) Show that the reduction in percentage transmittance labelled X occurs at a wavelength equal to approximately 5 μm.

(ii) Suggest, with reference to resonance, the possible reasons for the sharp reduction in percentage transmittance at a wavelength of 5 μm.

(iii) Explain how the reduction in percentage transmittance, labelled X on the graph opposite, accounts for the greenhouse effect.

(iv) Outline how an increase in the concentration of greenhouse gases in the atmosphere may lead to global warming.

Greenhouse gases

A. reflect infrared radiation but absorb ultraviolet radiation.

B. reflect ultraviolet radiation but absorb infrared radiation.

C. transmit infrared radiation but absorb ultraviolet radiation.

D. transmit ultraviolet radiation but absorb infrared radiation.