

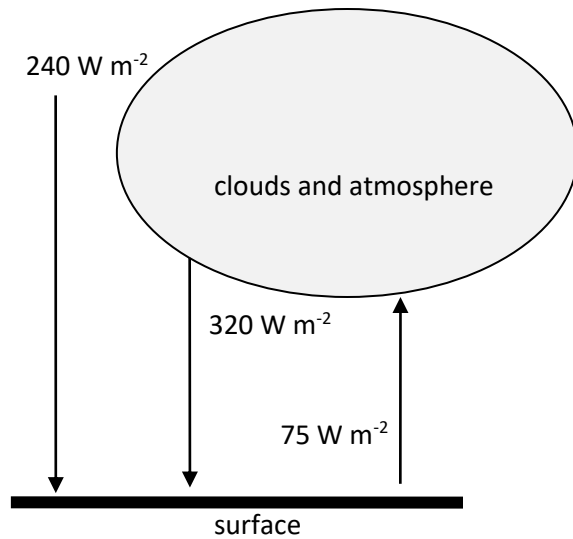
Quiz B8

The greenhouse effect

1. Body X has emissivity e and temperature 500 K. The surroundings of X radiate as a black body of temperature 300 K. What is the net intensity of radiation **leaving** X?
- A $e\sigma \times (500 - 300)^4$
B $e\sigma \times 500^4$
C $(1 - e) \times \sigma \times 300^4$
D $e\sigma \times (500^4 - 300^4)$
2. The albedo of a surface is α . Monochromatic radiation is incident on the surface. What is the fraction of the incident intensity that is absorbed by the surface and what fraction is reflected by the surface?

	Absorbed	Reflected
A	$1 - \alpha$	α
B	$1 - \alpha$	$1 - \alpha$
C	α	α
D	α	$1 - \alpha$

3. In a simple energy balance model the solar radiation intensity absorbed by the surface is 240 W m^{-2} , the downward radiation intensity from the atmosphere that is absorbed by the surface is 320 W m^{-2} . Thermal currents from the surface have an intensity 75 W m^{-2} .



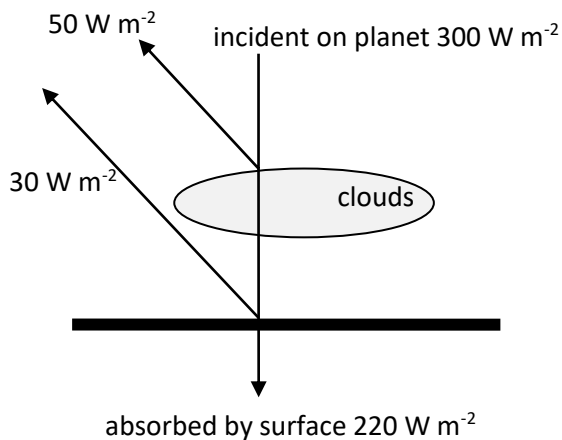
What is the intensity radiated by the surface?

- A 635 W m^{-2} B 560 W m^{-2} C 485 W m^{-2} D 155 W m^{-2}

4. The albedo of a planet is α and the emissivity of the surface is e . The planet is at a distance d from the Sun. The power radiated by the Sun is P . What is the equilibrium temperature of the planet?

- A $\sqrt[4]{\frac{(1-\alpha)P}{16\pi d^2 e\sigma}}$ B $\sqrt[4]{\frac{(1-\alpha)P}{4\pi d^2 e\sigma}}$ C $\sqrt[4]{\frac{\alpha P}{16\pi d^2 e\sigma}}$ D $\sqrt[4]{\frac{\alpha P}{4\pi d^2 e\sigma}}$

5. Radiation of intensity 300 W m^{-2} is incident on a planet. An intensity 50 W m^{-2} is reflected by the clouds and an intensity 30 W m^{-2} is reflected by the surface. The surface absorbs an intensity 220 W m^{-2} .



What is the albedo of the surface?

- A $\frac{3}{22}$ B $\frac{3}{25}$ C $\frac{4}{15}$ D $\frac{1}{6}$

6. Greenhouse gases in the atmosphere

- A absorb incoming ultraviolet radiation.
 B reflect incoming ultraviolet radiation.
 C absorb outgoing infrared radiation.
 D reflect outgoing infrared radiation.

7. The significance of greenhouse gases in the greenhouse effect is that they have molecular energy levels that typically differ by

- A 1 meV.
 B 1 eV.
 C 1 keV.
 D 1 MeV.

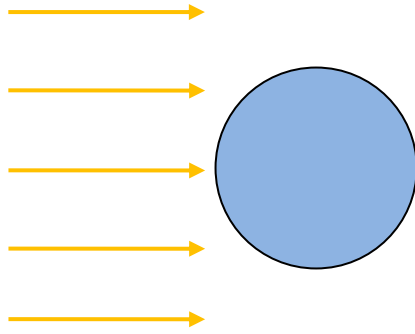
8. Region X of the Earth's surface is polar ice and region Y is a rainforest. What is a correct comparison of the intensity absorbed and the intensity reflected by X and Y as fractions of the incident intensity?

	Absorbed	Reflected
A	Greater for X	Greater for Y
B	Greater for X	Greater for X
C	Greater for Y	Greater for Y
D	Greater for Y	Greater for X

9. The albedo of a planet depends on all of the following **except** one. Which one?

- A Cloud formation
 B Nature of surface
 C Wavelength of the incident radiation
 D Intensity of the incident radiation

10. The intensity of solar radiation at the position of a planet is S . The albedo of the atmosphere of the planet is α .



What is the intensity of radiation incident on the planet surface averaged over the entire surface?

A $\alpha \frac{S}{2}$

B $\alpha \frac{S}{4}$

C $(1-\alpha) \frac{S}{2}$

D $(1-\alpha) \frac{S}{4}$

Quiz B8 Answers	
1	D
2	A
3	C
4	A
5	B
6	C
7	B
8	D
9	D
10	D