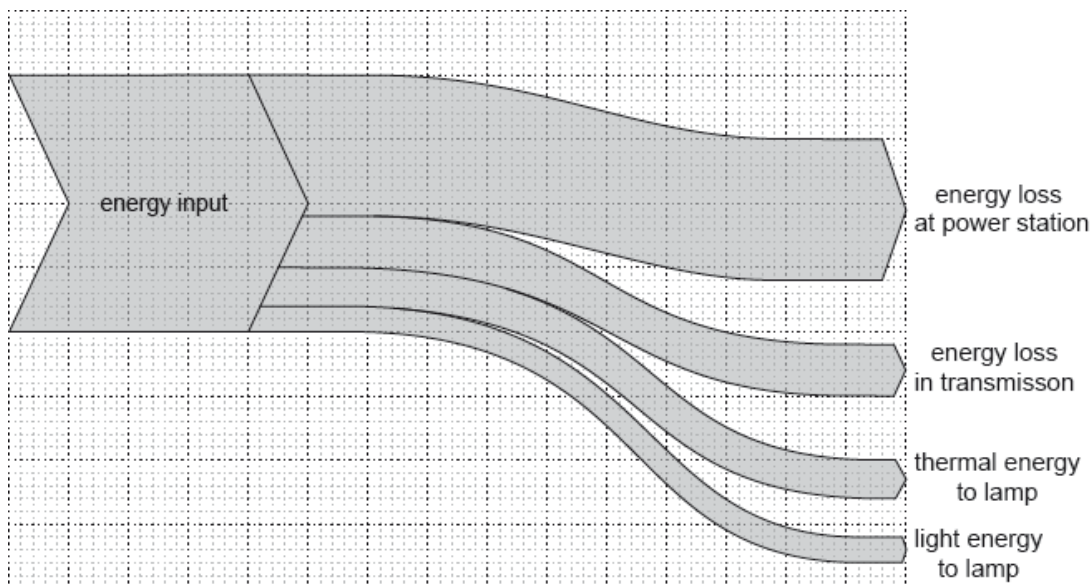


HL Paper 1

The Sankey diagram shows the energy input from fuel that is eventually converted to useful domestic energy in the form of light in a filament lamp.



What is true for this Sankey diagram?

- A. The overall efficiency of the process is 10%.
- B. Generation and transmission losses account for 55% of the energy input.
- C. Useful energy accounts for half of the transmission losses.
- D. The energy loss in the power station equals the energy that leaves it.

Markscheme

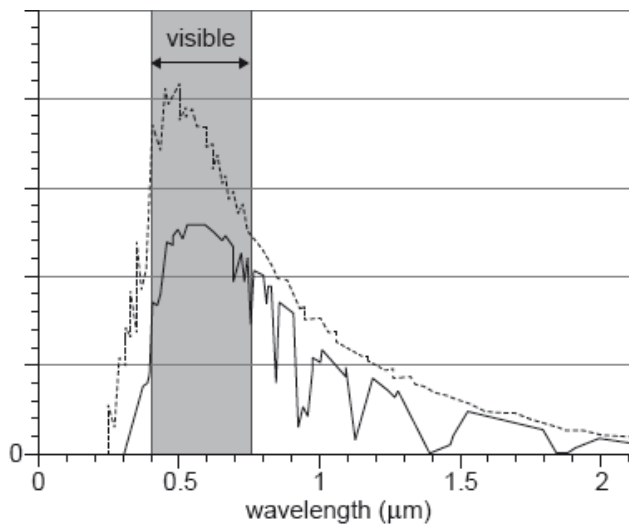
A

Examiners report

[N/A]

The dashed line on the graph shows the variation with wavelength of the intensity of solar radiation before passing through the Earth's atmosphere.

The solid line on the graph shows the variation with wavelength of the intensity of solar radiation after it has passed through the Earth's atmosphere.



[Source: Reproduced by permission of Martin Green, UNSW Sydney]

Which feature of the graph helps explain the greenhouse effect?

- A. Infrared radiation is absorbed at specific wavelengths.
- B. There is little absorption at infrared wavelengths.
- C. There is substantial absorption at visible wavelengths.
- D. There is little absorption at UV wavelengths.

Markscheme

A

Examiners report

[N/A]

Which of the following describes the role of the atmosphere in the greenhouse effect?

- A. The atmosphere is transparent to all solar radiation.
- B. The atmosphere absorbs infrared radiation from the ground.
- C. The atmosphere scatters red light more than blue light.
- D. Clouds in the atmosphere prevent absorption of infrared radiation.

Markscheme

B

Examiners report

A nuclear reactor contains atoms that are used for moderation and atoms that are used for control.

What are the ideal properties of the moderator atoms and the control atoms in terms of neutron absorption?

	Ideal moderator atom	Ideal control atom
A.	poor absorber of neutrons	poor absorber of neutrons
B.	poor absorber of neutrons	good absorber of neutrons
C.	good absorber of neutrons	poor absorber of neutrons
D.	good absorber of neutrons	good absorber of neutrons

Markscheme

B

Examiners report

[N/A]

The solar constant is the intensity of the Sun's radiation at

- A. the surface of the Earth.
- B. the mean distance from the Sun of the Earth's orbit around the Sun.
- C. the surface of the Sun.
- D. 10km above the surface of the Earth.

Markscheme

B

Examiners report

[N/A]

A black body has absolute temperature T and surface area A . The intensity of the radiation emitted by the body is I . Another black body of surface area $2A$ has absolute temperature $2T$. What is the intensity of radiation emitted by this second black body?

- A. $4I$
- B. $8I$
- C. $16I$

Markscheme

D

Examiners report

[N/A]

The average albedo of glacier ice is 0.25.

What is $\frac{\text{power absorbed by glacier ice}}{\text{power reflected by glacier ice}}$?

- A. 0.25
- B. 0.33
- C. 2.5
- D. 3.0

Markscheme

D

Examiners report

[N/A]

In a hydroelectric power plant, water of density 10^3kgm^{-3} falls through an average height of 100m. The volume of water flowing through the pipes per second is $10\text{m}^3\text{s}^{-1}$. What is the maximum power generated?

- A. 10^4W
- B. 10^5W
- C. 10^6W
- D. 10^7W

Markscheme

D

Examiners report

Many candidates did not factor in g . Without it, though, the units would have been incorrect.

In a nuclear power station, in order to increase the chances of a chain reaction

- A. kinetic energy is removed from the neutrons.
- B. kinetic energy is given to the neutrons.
- C. some neutrons are absorbed.
- D. extra neutrons are added.

Markscheme

A

Examiners report

[N/A]

What part of a nuclear power station is principally responsible for increasing the chance that a neutron will cause fission?

- A. Moderator
- B. Control rod
- C. Pressure vessel
- D. Heat exchanger

Markscheme

A

Examiners report

[N/A]

The rate of formation of a non-renewable energy resource is

- A. greater than the rate of consumption of the resource.
- B. less than the rate of consumption of the resource.
- C. always equal to zero.
- D. decreasing as the resource is consumed.

Markscheme

B

Examiners report

[N/A]

World energy resources include coal, nuclear fuel and geothermal energy. Which of the following lists these resources in order of energy use in the world?

- A. nuclear, geothermal, coal
- B. nuclear, coal, geothermal
- C. coal, geothermal, nuclear
- D. coal, nuclear, geothermal

Markscheme

D

Examiners report

In the production of electric power, an advantage of using photovoltaic cells rather than fossil fuels is that the photovoltaic cells

- A. can be effective in any location.
- B. can be used continuously.
- C. have low initial set-up costs.
- D. are more environmentally friendly when in use.

Markscheme

D

Examiners report

[N/A]

Which option is not a possible solution to reduce the enhanced greenhouse effect?

- A. Decommission nuclear power plants
- B. Replace the use of coal and oil with natural gas
- C. Use combined heating and power (CHP) systems
- D. Use hybrid motor vehicles

Markscheme

A

Examiners report

[N/A]

In a nuclear fission reactor, the role of the moderator is to

- A. absorb neutrons to shut down the reactor.
- B. speed neutrons up to increase the rate of energy production.
- C. slow neutrons down to decrease the rate of energy production.
- D. slow neutrons down to make a chain reaction more likely.

Markscheme

D

Examiners report

[N/A]

X and Y are two spherical black-body radiators that emit the same total power. The absolute temperature of X is half that of Y.

What is $\frac{\text{radius of X}}{\text{radius of Y}}$?

- A. 4
- B. 8
- C. 16
- D. 32

Markscheme

A

Examiners report

[N/A]

Methane and carbon dioxide are both greenhouse gases that are believed to cause global warming. The reason for this is that these gases

- A. absorb incoming radiation from the Sun.
- B. transmit the incoming radiation from the Sun and radiation from the Earth.
- C. reflect incoming radiation from the Sun.
- D. transmit incoming radiation from the Sun and absorb outgoing radiation from the Earth.

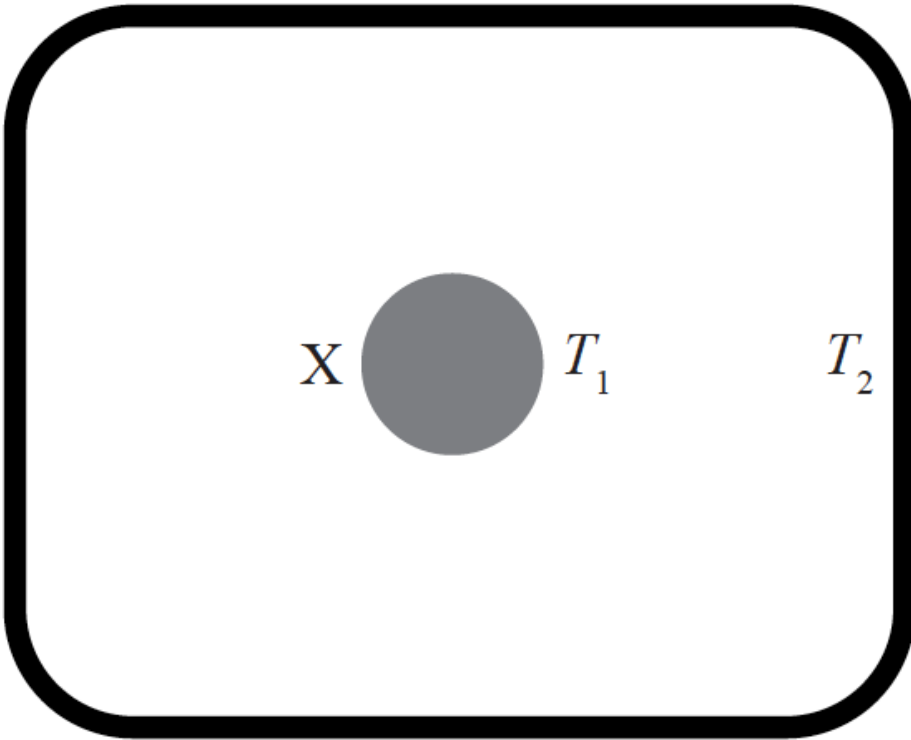
Markscheme

D

Examiners report

[N/A]

A body X of emissivity e is at temperature T_1 . X is inside a box whose walls act as a black body of temperature T_2 . T_1 is greater than T_2 .



What is the net intensity of radiation leaving body X?

- A. σT_1^4
- B. $e\sigma T_1^4$
- C. $e\sigma T_1^4 - \sigma T_2^4$

D. $e\sigma(T_1^4 - T_2^4)$

Markscheme

D

Examiners report

This was the only question that had a negative discrimination index, which means that the weaker candidates tended to prefer the correct response. As e is the emissivity of X and we are asked about the intensity of radiation leaving X, the correct response will be qualified by e . This automatically discounts A and C.

The temperature of T_2 is clearly relevant as the box is emitting radiation towards X, which X will need to re-radiate. Hence it can only be D.

An object can lose energy through

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

What are the principal means for losing energy for a hot rock resting on the surface of the Moon?

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

Markscheme

B

Examiners report

[N/A]

Which of the following statements, relating to the production of nuclear power, is correct?

- A. The fuel has high energy density.
- B. Supplies of nuclear fuels are unlimited.
- C. Greenhouse gas emissions are significant.
- D. Waste products are not significant.

Markscheme

Examiners report

[N/A]

Changes in the climate are leading to a reduction in ice cover on Earth. Which of the following describes, for Earth, the change in albedo and the change in the rate of energy absorption?

	Change in albedo	Change in rate of energy absorption
A.	decrease	decrease
B.	decrease	increase
C.	increase	increase
D.	increase	decrease

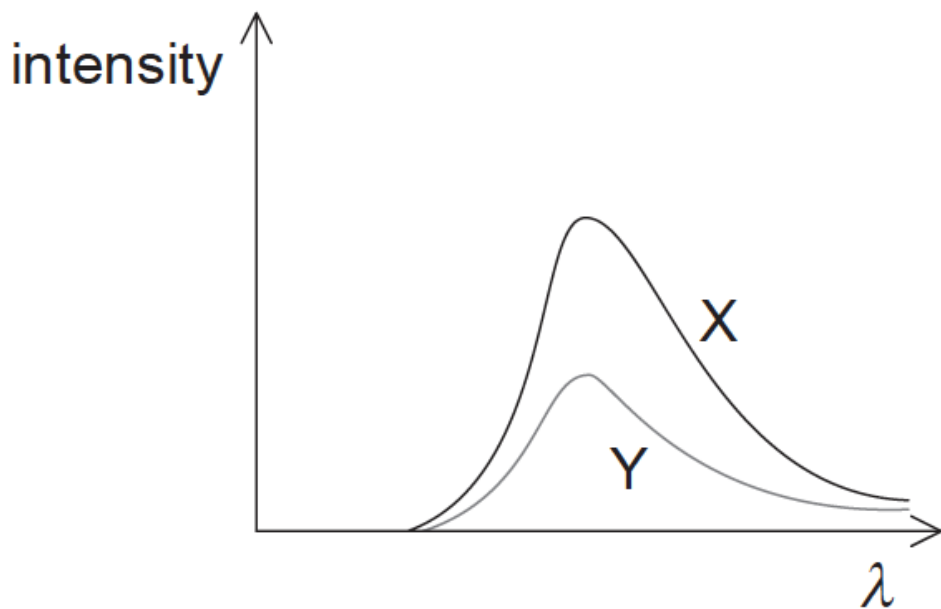
Markscheme

B

Examiners report

[N/A]

The graph shows the variation with wavelength of intensity of radiation emitted by two bodies X and Y. X and Y have the same surface area.



How do the temperature and the emissivity of X compare with the temperature and the emissivity of Y?

	Temperature	Emissivity
A.	different	different
B.	equal	different
C.	different	equal
D.	equal	equal

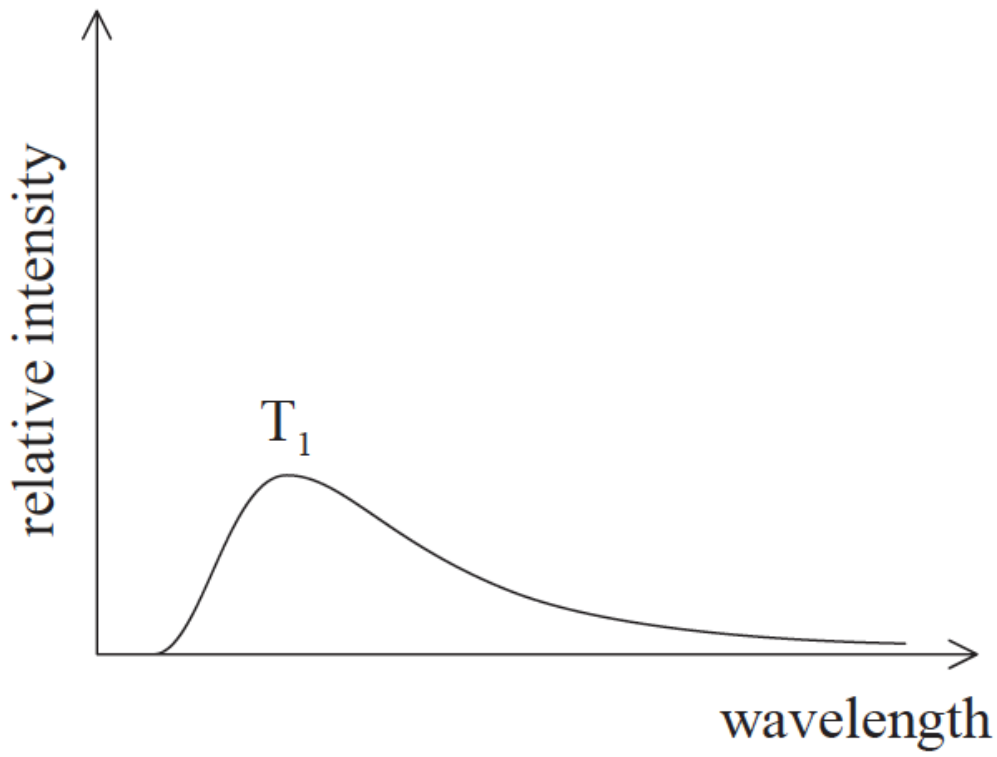
Markscheme

B

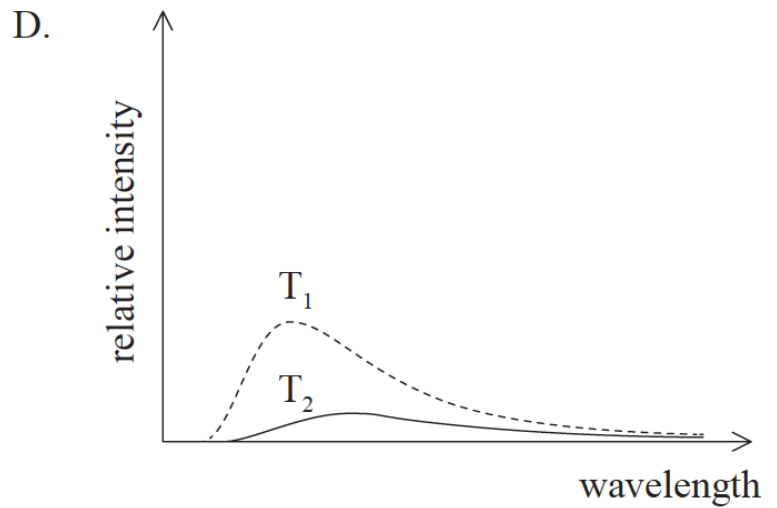
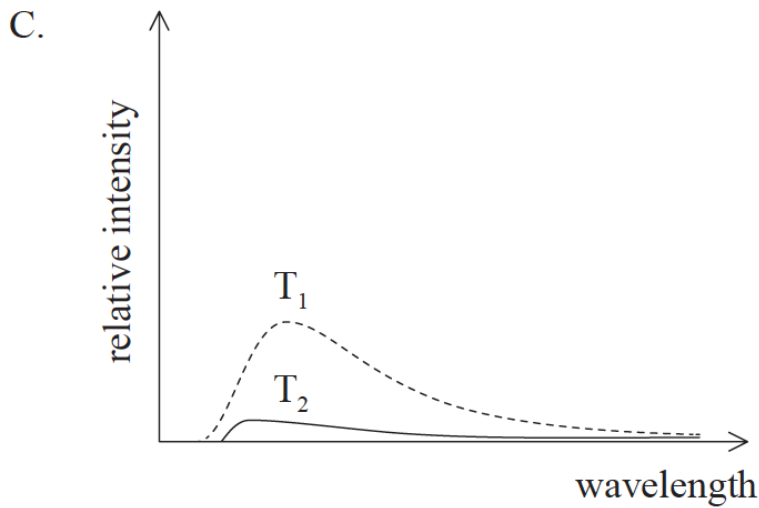
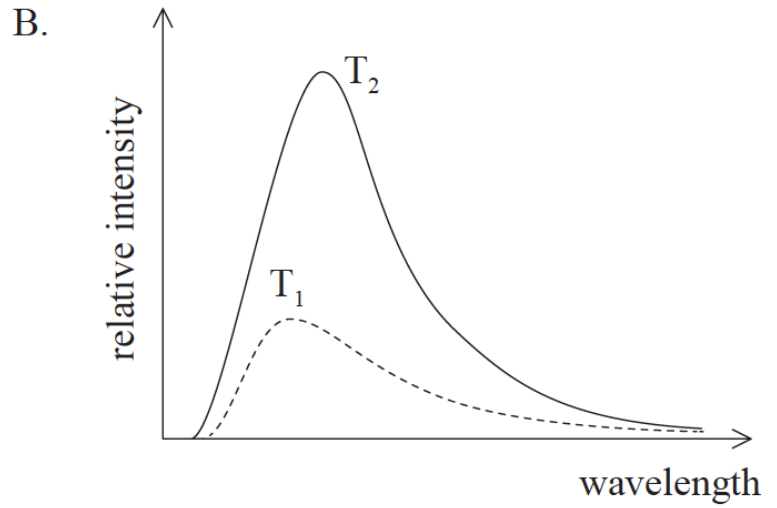
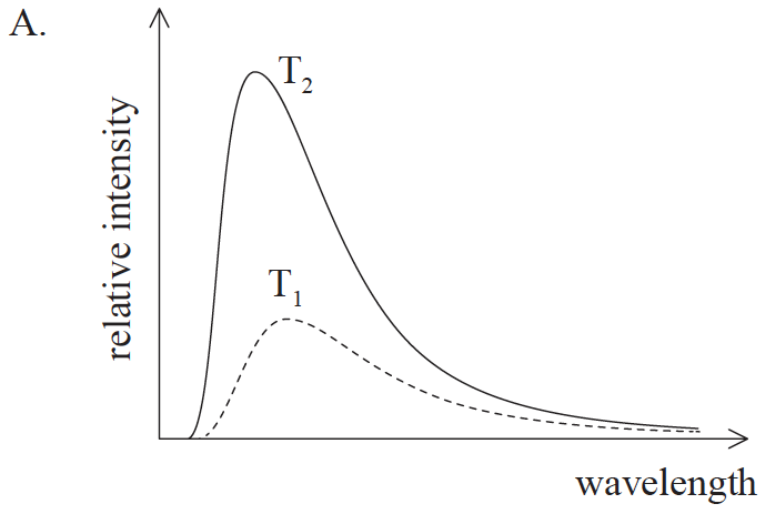
Examiners report

[N/A]

The graph shows the emission spectrum for a black body at absolute temperature T_1 .



Which graph shows the emission spectrum for the same black body at an absolute temperature T_2 where $T_2 > T_1$? The original graph is shown as a dotted line.



Markscheme

A

Examiners report

[N/A]
