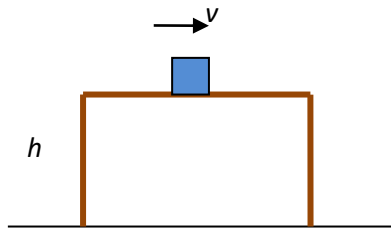**Quiz B7**

Thermal energy transfers

1. A solid block of mass M slides with speed v on a table that is at a height h from the floor.

The internal energy of the block consists of kinetic and potential energy. Four students define the kinetic and potential energy parts of internal energy in the answers below. Which is correct?

	Kinetic energy	**Potential energy**
A	The random kinetic energy of the molecules plus $\frac{1}{2}Mv^2$	Energy due to the forces between molecules
B	The random kinetic energy of the molecules plus $\frac{1}{2}Mv^2$	Energy due to the forces between molecules plus mgh
C	The random kinetic energy of the molecules	Energy due to the forces between molecules
D	The random kinetic energy of the molecules	Energy due to the forces between molecules plus mgh

2. Equal quantities of liquids X and Y are mixed. X is at 20 °C and Y is at 80 °C. The specific heat capacity of X is triple that of Y. What is the final temperature of the mixture?

   A 25 °C   **B** 35 °C   **C** 45 °C   **D** 65 °C

3. A quantity of 5.0 kg of a liquid is cooled at a constant rate. The specific heat capacity of the liquid is 1800 J kg^{-1} K^{-1}. The specific latent heat of fusion is 3×10^5 J kg^{-1}.
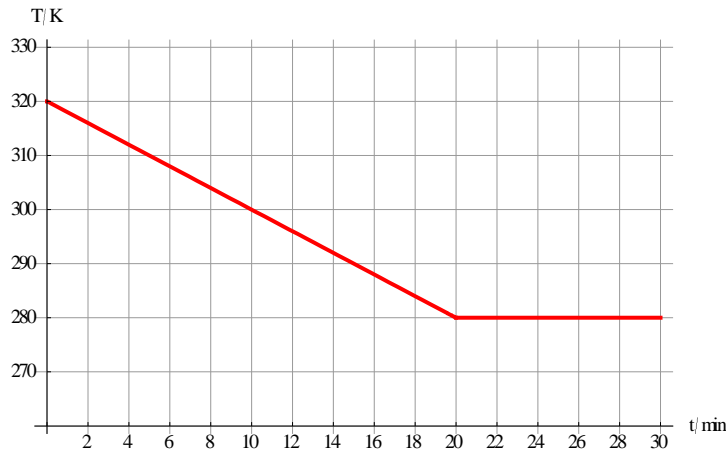

What mass of the substance is solid at 30 minutes?

A 0.60 kg   **B** 1.2 kg   **C** 4.4 kg   **D** 5.0 kg

4. Water of mass m at 90 °C is mixed with a mass M of steam at 100 °C. The temperature of the water is increased to 100 °C. The specific heat capacity of water is c and the specific latent heat of vaporization of water is L. What is the mass of liquid water in the water-steam system?

A $m - \dfrac{10ML}{c}$ **B** $m - \dfrac{10mc}{L}$ **C** $m + \dfrac{10ML}{c}$ **D** $m + \dfrac{10mc}{L}$

5. Two insulated rods, X and Y, of the same cross-sectional area are joined together. X has length L and thermal conductivity k. Y has length $2.5L$ and thermal conductivity $2k$. The ends are kept at constant temperatures $80\,^{\circ}\text{C}$ and $-10\,^{\circ}\text{C}$.
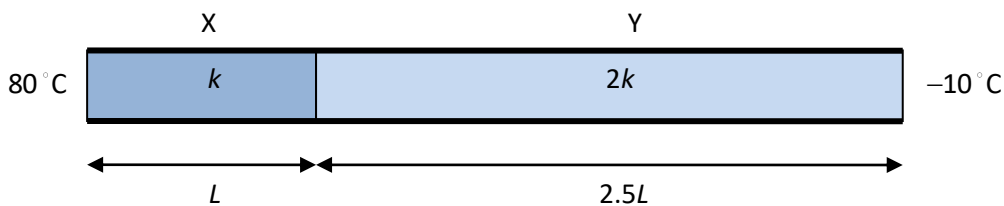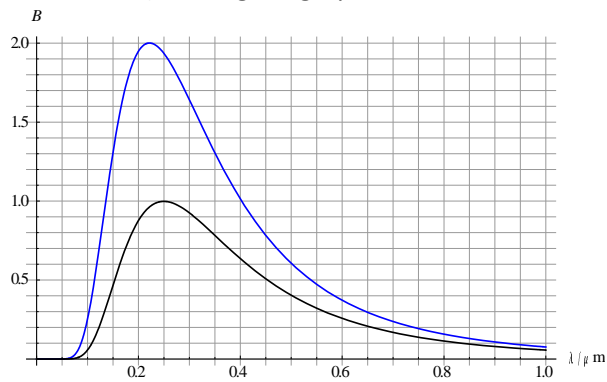

What is the temperature at the point where the rods join?

A $60\,^{\circ}\text{C}$ **B** $40\,^{\circ}\text{C}$ **C** $20\,^{\circ}\text{C}$ **D** $0\,^{\circ}\text{C}$
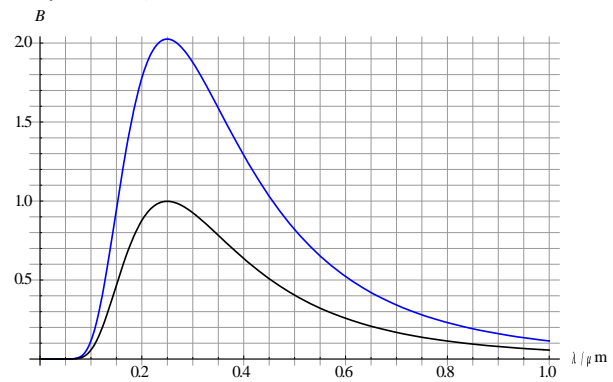
6. The graph shows the variation with wavelength of the spectral intensity B of a black body. The units of B are arbitrary.
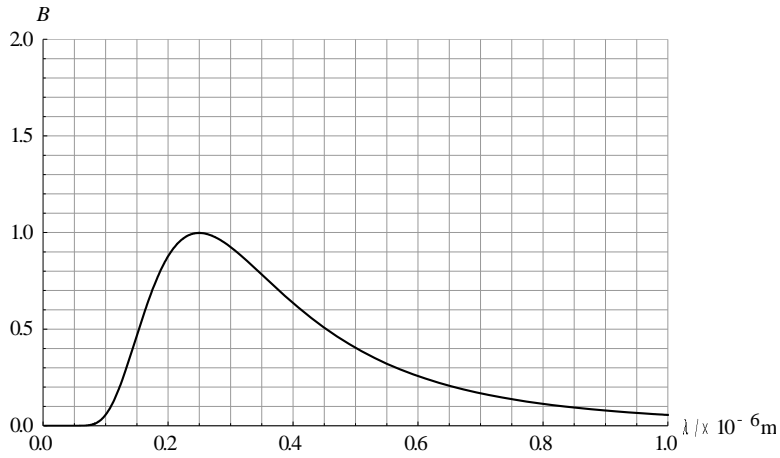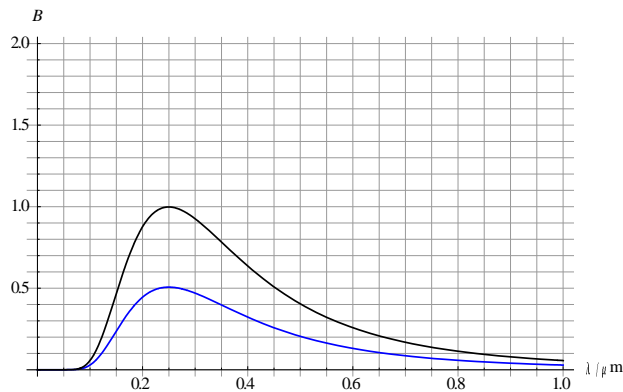

The temperature of the body is increased. Which graph shows the variation with wavelength of B? (The original graph is shown in black for comparison.)
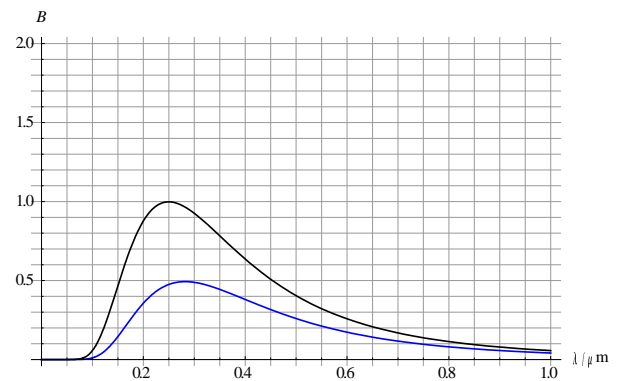

A

B

C

D

7. In the context of stars, what is luminosity and what is apparent brightness?

	Luminosity	Apparent brightness
A	The total power radiated by a star per unit area of the star surface	The total power received per unit area
B	The total power radiated by a star per unit area of the star surface	The total power received by an observer
C	The total power radiated by a star	The total power received per unit area
D	The total power radiated by a star	The total power received by an observer

8. The apparent brightness of a star is b, its distance from Earth is d and its luminosity is L. What is the luminosity of a star whose apparent brightness is $2b$ and its distance is $3d$?

    A $2L$ **B** $6L$ **C** $9L$ **D** $18L$

9. Two stars, X and Y, have the same luminosity. X has double the temperature of Y. What is the ratio $\dfrac{R_X}{R_Y}$, of the radius of X to that of Y?

    A $\dfrac{1}{2}$ **B** $\dfrac{1}{4}$ **C** $\dfrac{1}{8}$ **D** $\dfrac{1}{16}$

10. Star X has double the temperature of star Y, double its radius and double its distance. What is the ratio $\dfrac{b_X}{b_Y}$ of the apparent brightness of X to that of Y?

    A 4   **B** 16   **C** 32   **D** 64

Quiz B7 Answers	
1	C
2	B
3	A
4	D
5	B
6	A
7	C
8	D
9	B
10	B