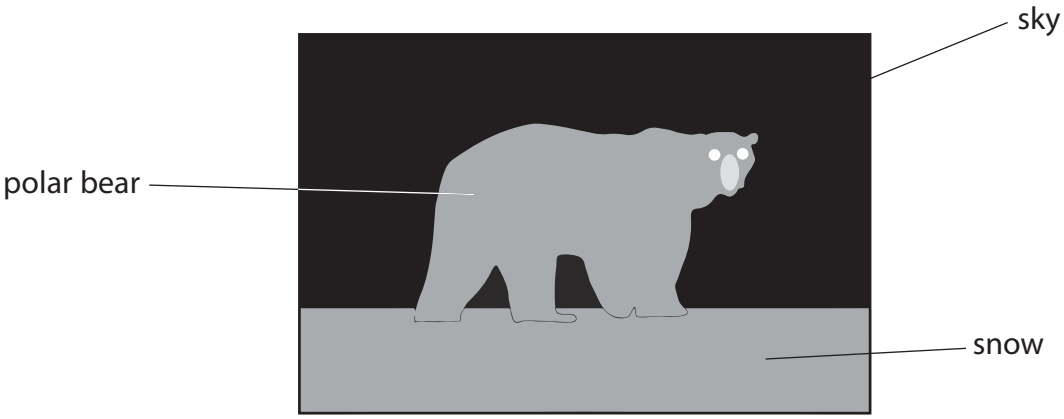
12 Polar bears have thick fur to keep them warm.

(a) This photograph of a polar bear was taken using visible light.

The diagram shows a thermal image of the same scene.



Darker colours in this image indicate lower temperatures.

Discuss what information the image gives about the temperatures of the objects shown.

(2)

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(b) The polar bear's fur includes short hairs and longer hairs.

These longer hairs are hollow and contain air.

(i) Explain how its fur reduces the amount of thermal energy lost by the polar bear.

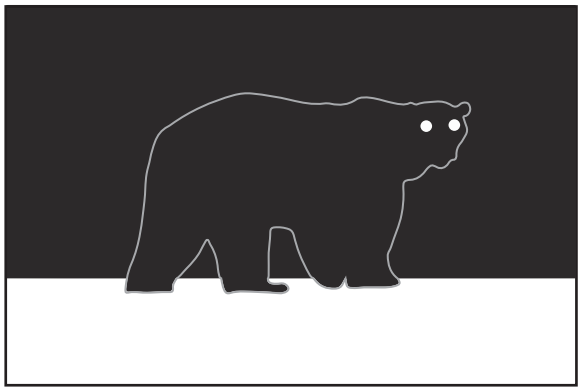
(2)

(ii) Underneath its white fur, a polar bear has black skin.

Discuss how these colours affect the overall amount of thermal energy lost by the polar bear's body.

(3)

(c) The diagram shows another image of the same scene.



The image was made during the day using ultraviolet rays from the Sun.

Brighter colours in this image indicate larger amounts of ultraviolet radiation.

The grey line is added to show the position of the polar bear.

(i) Compare the absorption and reflection of ultraviolet rays by the objects shown in the image.

(2)

(ii) Suggest why the sky appears dark, even though the Sun emits ultraviolet rays.

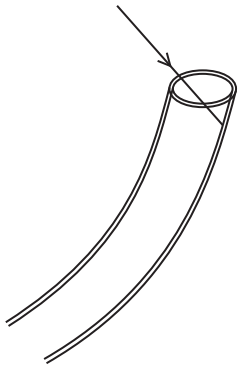
(1)

(iii) The hollow hairs in polar bear fur are transparent tubes filled with air.

It was thought that these hairs could act like optical fibres and guide ultraviolet rays down to the polar bear's skin.

It is now known that this idea is **incorrect**. The ultraviolet rays do **not** reach the polar bear's skin.

The diagram shows an ultraviolet ray entering the air inside a hollow hair.



Suggest why this radiation does not pass down to the polar bear's skin.

(2)

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(Total for Question 12 = 12 marks)

TOTAL FOR PAPER = 120 MARKS