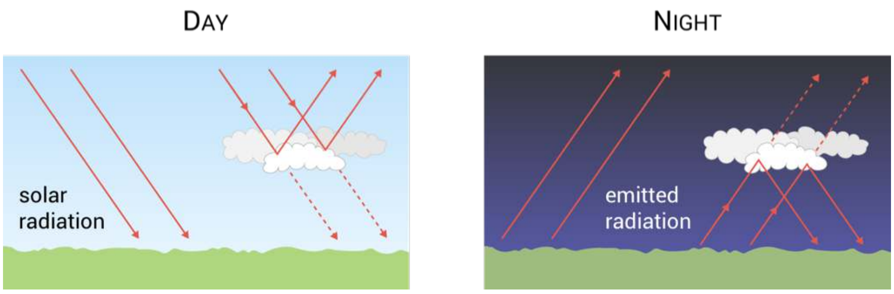
0 1

The below diagram shows the same region of the surface of the Earth during both the day and the night. The arrowed lines represent the paths of rays of thermal (infrared) radiation. The dotted lines represent radiation which has been partially transmitted through clouds.



0 1 . 1

In general, daytime temperatures tend to be higher when there is little to no cloud cover. Explain why. You may refer to the above diagram in your answer.

When there are no clouds, the amount of solar radiation (sunlight) transmitted to the surface is a maximum [1]. Clouds absorb and reflect some of this radiation, which reduces the amount which reaches the surface [1].

0 1 . 2

After the sun has set, surface temperatures tend to fall more rapidly when there is a clear sky. Explain why.

When there is a clear sky, more of the infrared radiation which is emitted by the surface is transmitted directly to space [1] and so the surface temperature decreases quickly. When there are clouds in the sky, some of this radiation is reflected (or absorbed and re-radiated) back towards the ground [1].

0 2

One of the ways in which astronomers categorise stars is by measuring their colour (or *spectral type*). The way in which the colour of a star depends on its surface temperature is shown in the below diagram. Temperatures have been quoted in kelvin (K).

02.1 Describe the relationship between the colour of a star and its surface temperature, then explain why a star which appears blue is hotter than one which appears white.

As the temperature of a star increases, it emits (more) radiation at shorter wavelengths [1]. White light is formed when all of the colours of the visible spectrum are combined in (roughly) equal amounts; a star which is hotter than white-hot emits more blue light than visible light of other wavelengths, and so appears blue [1].

02.2 A star is very close to being a perfect **black body**.
Explain what is meant by the term *perfect black body*.

A perfect black body is an object which *absorbs* all of the radiation incident on it [1] and does not *reflect* or *transmit* any radiation [1]. A perfect black body is also the best possible *emitter* of radiation [1]. Any TWO.

03 An electric heater is placed into a completely dark room, before being turned on.

03.1 Jeff tells you that he believes that the heater was not emitting any electromagnetic radiation before it was turned on. Write down one thing you could do which would prove that he was incorrect.

EITHER view the heater in a dark room using a (very sensitive) thermal imaging (infrared) camera [1] OR place the heater into the room when the temperatures of both the heater and room are (noticeably) different [1]. If a warm heater is brought into a cold room for example, the heater will emit more infrared radiation than it absorbs until the point at which both the heater and the room are at the same temperature.

This is a fairly tricky concept, but remember that, even before it is switched on, the heater will be emitting some infrared radiation (which is invisible to us). Although living things such as humans (and cows!) tend to be hotter and emit more infrared than room temperature objects, pretty much everything around us will emit *some* infrared.

03.2 Describe how the radiation emitted by the heater changes once it is turned on.

The heater emits more radiation [1] at shorter wavelengths [1].
('It glows red hot' for one mark.)