

Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 9_Thermodynamics

Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

Water at 100 °C turns into steam at 100 °C.

Which of the following statements is true?

- ☐ **A** The internal energy is unchanged, but the kinetic energy of the molecules increases.
- ☐ **B** The internal energy is unchanged, but the potential energy of the molecules increases.
- ☐ **C** Both the internal energy and the kinetic energy of the molecules increase
- ☐ **D** Both the internal energy and the potential energy of the molecules increase

(Total for question = 1 mark)

Q2.

Tomatoes can be made into a puree.

The puree is heated. When the puree boils, its temperature stays constant, even though the puree continues to be heated.

Explain this observation in terms of molecular energy changes.

(2)

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(Total for question = 2 marks)

Q3.

Barnard's star is a red dwarf star in the vicinity of the Sun. The wavelength of a line in the spectrum of light emitted from Barnard's star is measured to be 656.0 nm. The same light produced by a source in a laboratory has a wavelength of 656.2 nm.

Visible light from the star originates from the photosphere. In the photosphere of Barnard's star, hydrogen and helium atoms are at a temperature of 3100 K.

(i) Calculate the mean kinetic energy of an atom in the photosphere at a temperature of 3100 K.

(2)

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Mean kinetic energy = ...

(ii) Describe how these atoms emit visible light.

(2)

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(Total for question = 4 marks)

Q4.

In 2016 the Breakthrough Starshot initiative was announced. This project intends to send a fleet of small probes to Proxima Centauri, the nearest star to the Sun. This journey would take about twenty years.

The radiation intensity at Earth from Proxima Centauri is $3.25 \times 10^{-11} \text{ W m}^{-2}$. The luminosity of the Sun is $L_{\odot}$.

(i) Show that the luminosity of Proxima Centauri is about $0.002 L_{\odot}$.

(3)

distance to Proxima Centauri = $4.00 \times 10^{16} \text{ m}$

$L_{\odot} = 3.85 \times 10^{26} \text{ W}$

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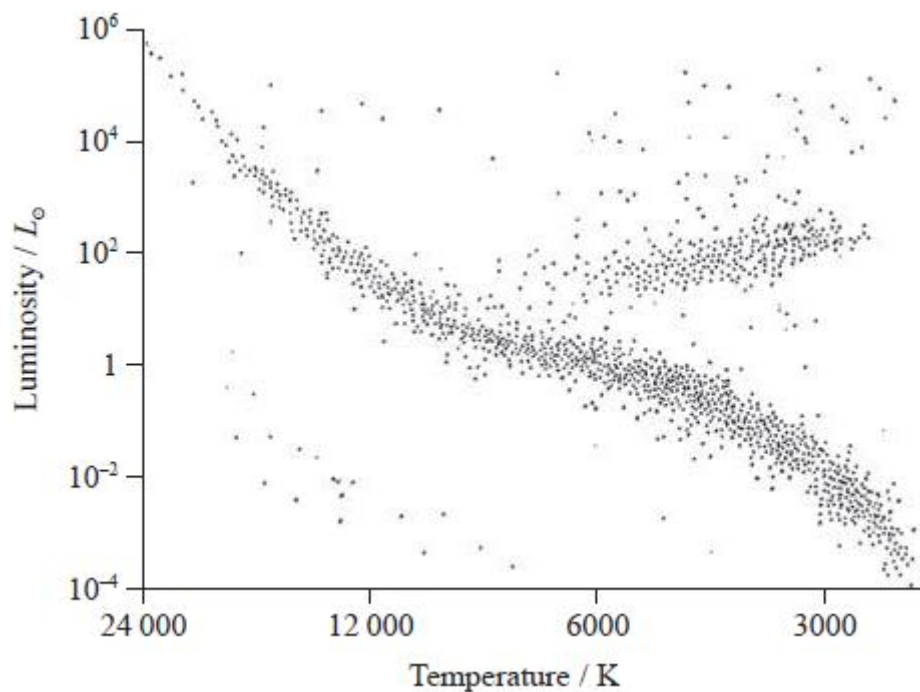
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(ii) Proxima Centauri is described on a website as a main sequence star.

Determine whether the surface temperature of Proxima Centauri is consistent with a position on the main sequence of the Hertzsprung-Russell diagram.

(3)

radius of Proxima Centauri = $9.81 \times 10^7 \text{ m}$



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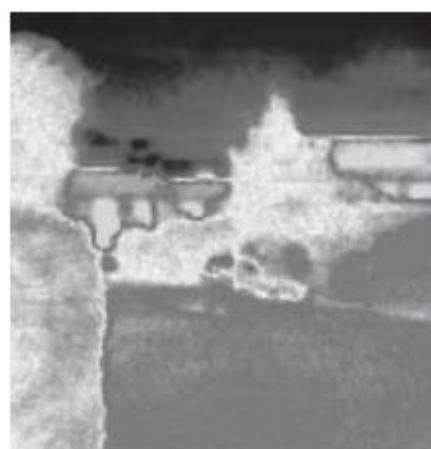
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(Total for question = 3 marks)

Q5.

Infrared cameras are used to create images that show the infrared radiation emitted by objects. The photographs show the same scene taken first with an ordinary camera and then with an infrared camera.



Deduce whether the objects shown in the photographs would be expected to have peak emissions at infrared wavelengths. Your answer should include a calculation.

(4)

longest wavelength of visible red light $\approx 700 \text{ nm}$

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(Total for question = 4 marks)