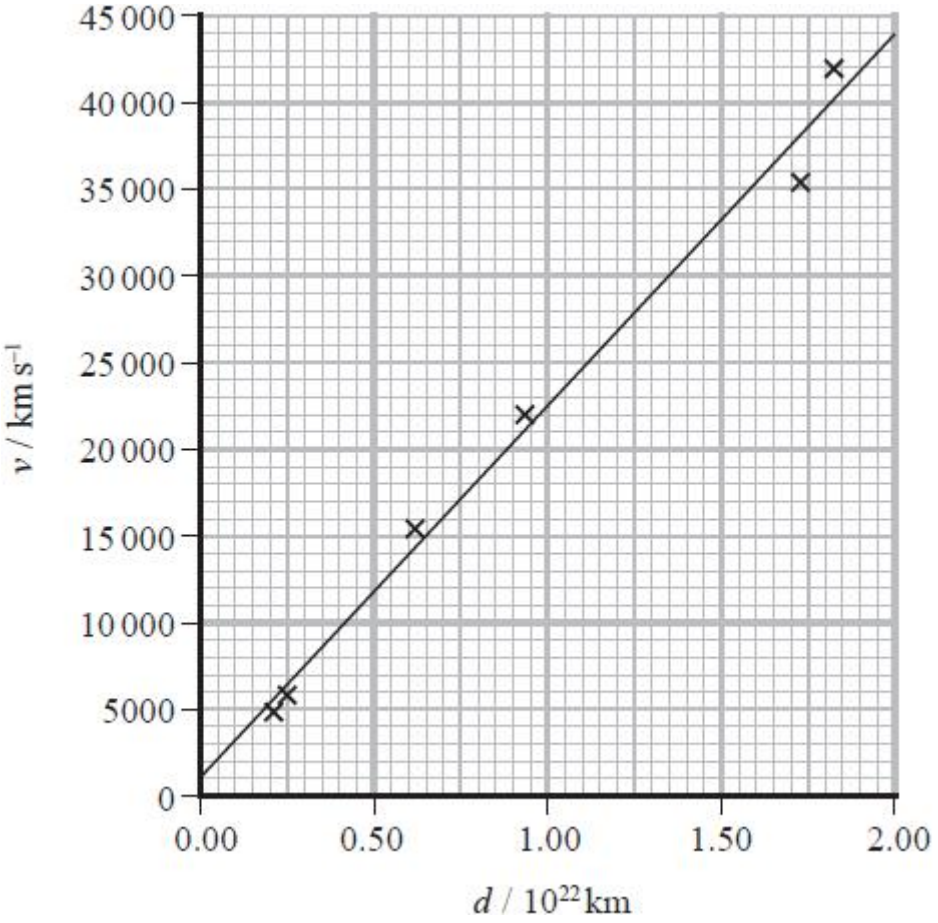
Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

In 1990, the Hubble Space Telescope (HST) was launched into a low Earth orbit above the Earth's atmosphere.

High resolution images from HST allow astronomers to make detailed measurements of very distant galaxies. The graph shows how the recessional velocities of distant galaxies depend on their distance from Earth.



Determine an age for the universe.

(3)

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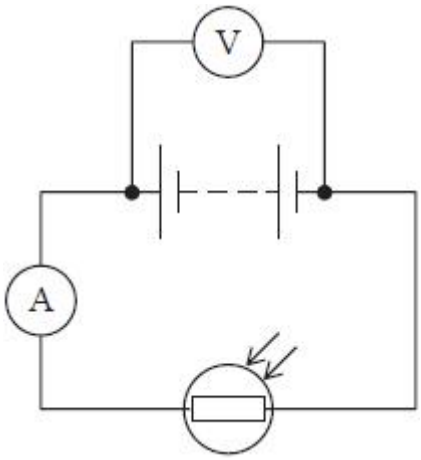
Age for the universe = ...

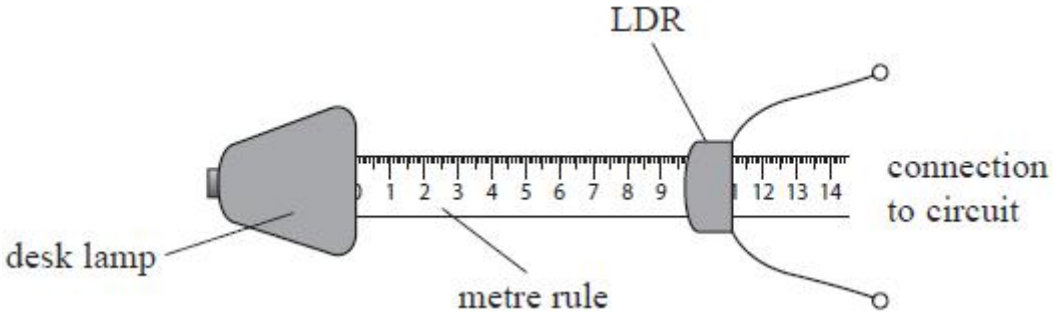
(Total for question = 3 marks)

Q2.

A student carried out an experiment with a light dependent resistor (LDR). He connected the LDR in series with an ammeter and a power supply, as shown in the circuit diagram.



The student placed the LDR a known distance from a desk lamp, as shown.



The student noted the reading on the ammeter as he brought the LDR closer to the lamp.

The student planned to vary the intensity of light incident upon the LDR by adjusting the distance *x* between the LDR and the lamp.

He thought that the intensity of light on the LDR would increase uniformly if he decreased *x* by equal intervals. He therefore planned to take ammeter readings as he decreased *x* from 20.0 cm to 10.0 cm in equal intervals.

(i) Criticise the student's plan for data collection.

(3)

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(ii) Explain one precaution that the student should take to ensure that results are accurate.

(2)

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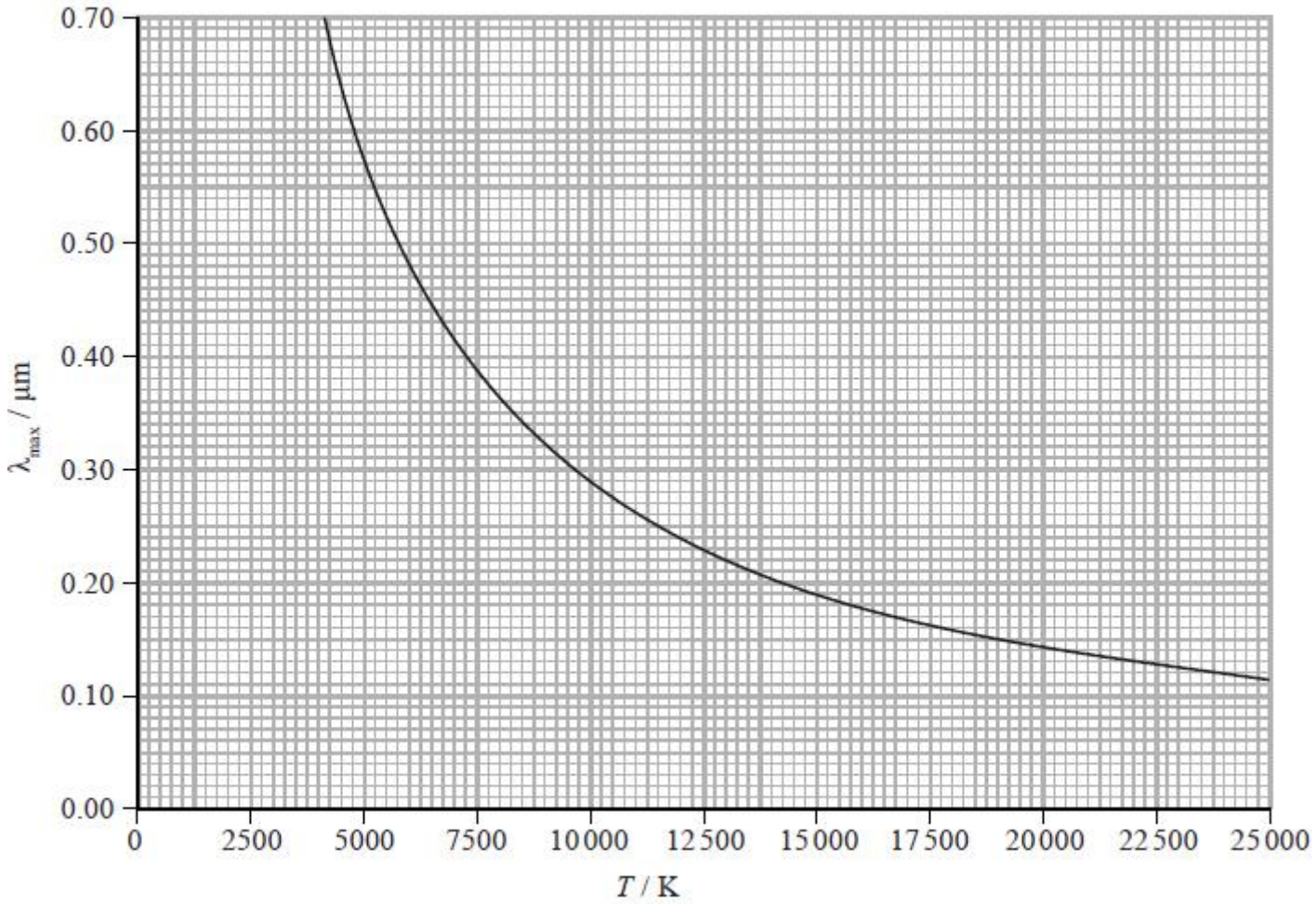
(Total for question = 5 marks)

Q3.

Rigel A in the constellation of Orion is one of the brightest stars in the sky. It is a massive blue variable star with an intensity peak at a wavelength λ_{max} of 0.25 μm.

The graph below shows how λ_{max} varies with temperature T for a black body radiator.



(i) Use the graph to estimate the surface temperature of Rigel A.

(1)

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(ii) Show that the graph is consistent with Wien's law.

(3)

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Q4.

A converging lens can be used to produce a real image on a screen.

A magazine article includes the statement:

> If the distance from the lens to the screen is doubled, the brightness of the image is halved.

Assess the validity of this statement.

(2)

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(Total for question = 2 marks)

Q5.

Analysing the light from a star allows elements present in its outer atmosphere to be identified because each element produces a distinctive set of spectral lines.

*(a) Describe how a spectral line is produced by a hot gas, explaining why a particular element can only give rise to particular frequencies.

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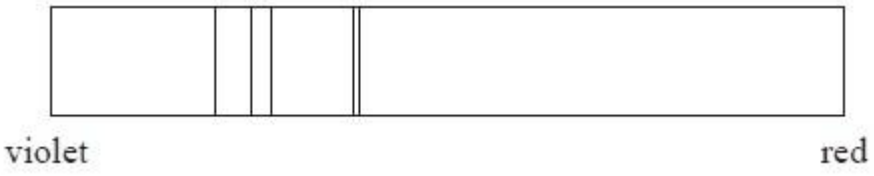
(b) The diagram shows the spectral lines produced by a particular element when observed in a laboratory.



The diagram below shows the spectral lines obtained by analysing the light from a star. This shows the same pattern of lines, but in a different part of the spectrum.

Name this effect and explain what may be deduced about the motion of this star relative to the Earth.

(3)

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(c) Suggest what the phenomena in parts (a) and (b) imply about the nature of light.

(1)

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(Total for Question = 10 marks)