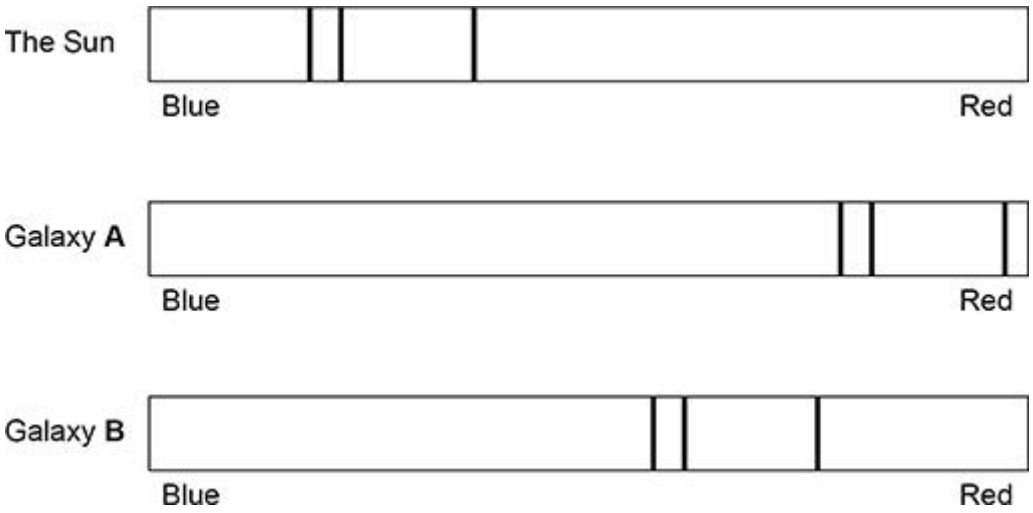
Questions are for separate science students only

Q1.

(a) The light spectrum from every galaxy includes dark lines. **(Physics only)**

The lines have the same pattern.

The figure below shows the position of dark lines in the visible spectra of light from the Sun and from two distant galaxies.



Explain what these light spectra tell us about the velocities of galaxy **A** and galaxy **B**.

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(3)

(Total 3 marks)

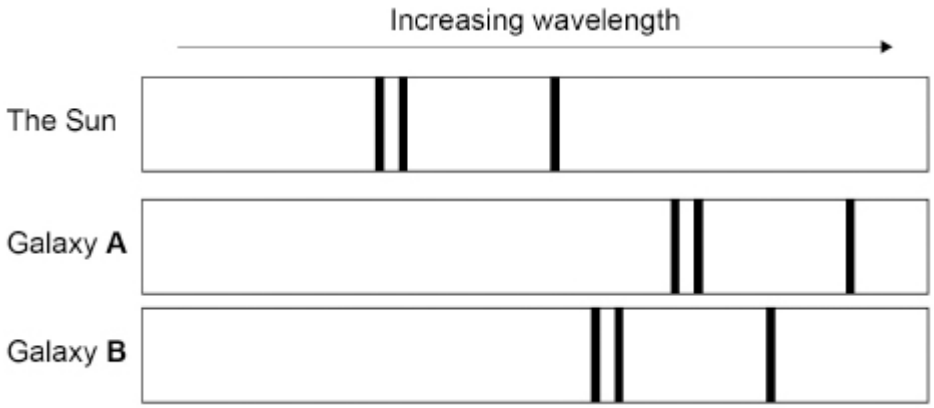
Q2.

(a) The Hubble Space Telescope can detect visible light from distant galaxies. **(Physics only)**

The visible light spectra from stars and galaxies include dark lines at specific wavelengths.

Figure 2 shows the visible light spectra from the Sun and two galaxies.

Figure 2



Explain what conclusions can be made about galaxies **A** and **B**.

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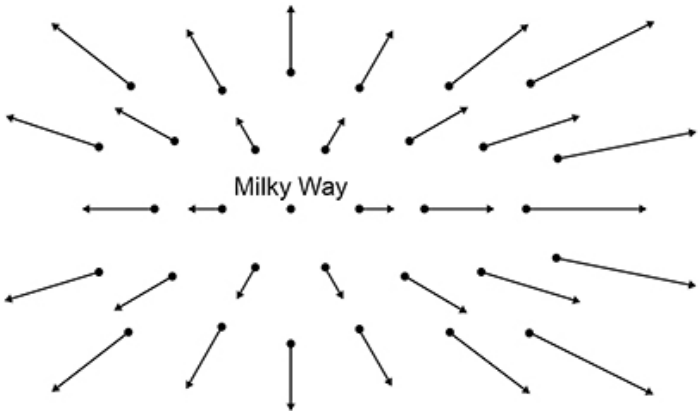
(3)

(Total 3 marks)

Q3.

The points on diagram below represent galaxies that are moving away from the Milky Way. **(Physics only)**



Each arrow represents the velocity of the galaxy relative to the Milky Way.

(a) Light from all galaxies represented in diagram above is red-shifted.

Describe what is meant by red-shift.

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(2)

(b) Explain how above diagram provides evidence for the Big Bang theory.

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(2)

(c) Sometimes scientists have to change theories about the universe.

Give the reason why.

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(1)

(Total 5 marks)