

# Edexcel Physics A-Level

## Topic 10.2 - Red Shift and the Universe

### Flashcards

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# What is the doppler effect?



## What is the doppler effect?

The doppler effect is the apparent change of wavelength as result of relative movement between a receiver and source.



What happens to the observed wavelength of a wave source moving away from the observer?



What happens to the observed wavelength of a wave source moving away from the observer?

The observed wavelength will increase.



What happens to the observed wavelength of a wave source moving towards an observer?



What happens to the observed wavelength of a wave source moving towards an observer?

The observed wavelength will decrease.



What happens to the observed frequency of a wave source moving towards an observer?





What happens to the observed frequency of a wave source moving towards an observer?

The observed frequency will increase.



# What is red-shift?



## What is red-shift?

Red-shift is the apparent shift of the wavelength of light emitted by a star towards the red end of the light spectrum, as a result of it receding.



What equations are used to calculate red-shift?



What equations are used to calculate red-shift?

$$z = \frac{\Delta\lambda}{\lambda} \approx \frac{\Delta f}{f} \approx \frac{v}{c}$$



Describe how the relative speed value inputted into the equation differs depending on whether the source and receiver are nearing or receding.



Describe how the relative speed value inputted into the equation differs depending on whether the source and receiver are nearing or receding.

If the source and receiver are approaching each other, the value should be negative, otherwise the value is positive.



What is the difference between a positive and negative 'z' value?





What is the difference between a positive and negative 'z' value?

A positive 'z' value represents red shift, whereas a negative value represents blue shift.



What are the two main conclusions that can be drawn from observations of red shift from distant galaxies?



What are the two main conclusions that can be drawn from observations of red shift from distant galaxies?

1. All galaxies show red shift and so all galaxies are moving away
2. The more distant a galaxy is, the greater its red shift and so the faster it is receding



What does the red-shift of distant galaxies provide evidence for?



What does the red-shift of distant galaxies provide evidence for?

Red-shift of distant galaxies suggests that they are moving away from us. This supports the concept that the universe is expanding, which supports the Big Bang theory.



# What does CMBR stand for?



What does CMBR stand for?

Cosmic Microwave Background  
Radiation



# What is cosmic microwave background radiation?





# What is cosmic microwave background radiation?

Radiation in the microwave region of the EM spectrum that is present in very small quantities all around us.



How does the existence of CMBR support the Big Bang theory?



## How does the existence of CMBR support the Big Bang theory?

In the big bang, lots of high energy radiation was produced. As the universe has expanded over time, the wavelength of this radiation has been 'stretched' so that it is now in the microwave region. Other theories of the universe can't account for the existence of CMBR.



# What is the Big Bang theory?



## What is the Big Bang theory?

The Big Bang theory is a theory for the formation of the universe. It proposes that the universe began from a very small, hot and dense region, and expanded from this point.



What two quantities does Hubble's law relate?



What two quantities does Hubble's law relate?

The distance of a galaxy to the speed at which it is moving away.



Express Hubble's law in words.





Express Hubble's law in words.

The speed at which a galaxy is moving away, is directly proportional to the distance it is at.



State the defining equation for Hubble's law.



State the defining equation for Hubble's law.

$$v = H_0 d$$

Where  $H_0$  is Hubble's Constant



Describe what was observed when observations of galaxies' brightnesses were compared to the predictions made by Hubble's Law.



Describe what was observed when observations of galaxies' brightnesses were compared to the predictions made by Hubble's Law.

- The actual and predicted brightnesses of distant galaxies don't always agree with each other
- Distant galaxies aren't as bright as predicted by Hubble's Law, suggesting that they are more distant than predicted



State the conclusion that can be made from Hubble's Law and observations.



State the conclusion that can be made from Hubble's Law and observations.

The rate of expansion of the universe is accelerating, since galaxies are further away than predicted.



Give one possible explanation for the acceleration of the universe's expansion.





Give one possible explanation for the acceleration of the universe's expansion.

The existence of dark energy. This would explain where the energy required for the expansion rate to constantly accelerate comes from.



Why is the existence of dark energy still only a hypothesis?



Why is the existence of dark energy still only a hypothesis?

Dark matter and energy can't easily be observed.

