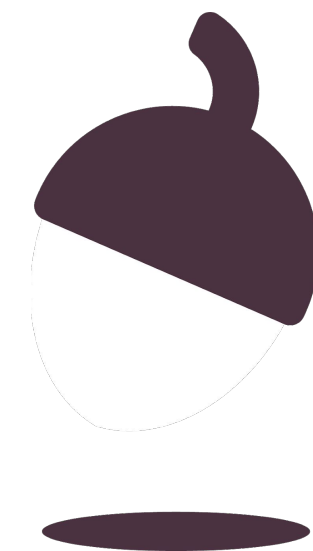


Physics - Key Stage 4
Space

Origins of the universe

Students' downloadable resources

Mr C White



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Question slides from video



Independent task 1

- (1) What is meant by the 'visible spectrum'?
- (2) What happens in an atom when electromagnetic energy is absorbed?
- (3) What happens in an atom when electromagnetic energy is emitted?
- (4) Write out the order of the colours in the visible spectrum in order of wavelength, shortest first.
- (5) Give the name of a colour of visible light that has a higher frequency than blue.
- (6) What is the difference in appearance between an emission spectrum and an absorption spectrum?



Independent task 2

- (1) What is meant by the 'Doppler Effect'?
- (2) Describe how the pitch of a sound would change as (a) the source of the sound approached you and (b) the source of the sound moved away from you.
- (3) Explain what happens to the spectral lines of the light emitted by a distant galaxy if the galaxy is receding.
- (4) What is the relationship between the distance to a galaxy and its recessional velocity (how fast it is moving away)?
- (5) Sketch a graph to show the relationship in question 4, with distance on the x-axis.



EXAM STYLE QUESTIONS - PART ONE

- (1) In the late 1920s, Edwin Hubble made measurements suggesting that galaxies were receding from Earth.
- (a) What measurement did Hubble take to reach this conclusion? (1 mark)
 - (b) What relationship did Hubble discover that linked speed of a galaxy to its distance from Earth? (2 marks)
 - (c) Explain how Hubble's findings supported the idea that the universe was expanding. (2 marks)
 - (d) What is meant by the term, 'Big Bang'? (3 marks)



EXAM STYLE QUESTIONS - PART TWO

(2) Stars have been observed in our galaxy (the Milky Way) that orbit around other stars show both red and blue shifted line spectra, depending on when measurements are made.

(a) Suggest why these stars show changing Doppler shifts over time. (3 marks)

A nearby galaxy, Andromeda, is blue shifted.

(b) Suggest what this measurement shows about Andromeda and what could be causing this result. (2 marks)



Answers



Independent Task 1 - SOLUTIONS

- (1) What is meant by the 'visible spectrum'? **The region of the electromagnetic spectrum that can be detected with our eyes**
- (2) What happens in an atom when electromagnetic energy is absorbed? **Electrons move up/get promoted to higher orbits/energy levels**
- (3) What happens in an atom when electromagnetic energy is emitted? **Electrons fall down/get demoted to lower orbits/energy levels (N.B. could also be energy from the nucleus as gamma radiation)**
- (4) Write out the order of the colours in the visible spectrum in order of wavelength, shortest first. **Violet, indigo, blue, green, yellow, orange, red**
- (5) Give the name of a colour of visible light that has a higher frequency than blue. **indigo/violet**
- (6) What is the difference in appearance between an emission spectrum and an absorption spectrum? **Emission spectrum is individual bright lines on black background, absorption spectrum has individual black lines on a continuous spectrum background**



Independent task 2 - SOLUTIONS

- (1) What is meant by the 'Doppler Effect'? **an increase (or decrease) in the frequency of sound, light, or other waves as the source and observer move towards (or away from) each other**
- (2) Describe how the pitch of a sound would change as (a) the source of the sound approached you **pitch would increase** and (b) the source of the sound moved away from you **pitch would decrease**
- (3) Explain what happens to the spectral lines of the light emitted by a distant galaxy if the galaxy is receding. **Spectral lines are shifted towards the red end of the spectrum/are red shifted**
- (4) What is the relationship between the distance to a galaxy and its recessional velocity (how fast it is moving away)? **Directly proportional**
- (5) Sketch a graph to show the relationship in question 4, with distance on the x-axis.

y-axis = recessional velocity, x-axis = distance, straight line through origin, positive gradient



EXAM STYLE QUESTIONS - SOLUTIONS (1)

- (1) In the late 1920s, Edwin Hubble made measurements suggesting that galaxies were receding from Earth.
- (a) What measurement did Hubble take to reach this conclusion? (1 marks) **red shift of galaxies/recessional velocities of galaxies**
- (b) What relationship did Hubble discover that linked speed of a galaxy to its distance from Earth? (1 mark) **recessional velocity was directly proportional to distance from Earth**
- (c) Explain how Hubble's findings supported the idea that the universe was expanding. **As the distance from Earth increased, the recessional velocity of galaxies increased (1) , showing that the space between galaxies was increasing/space is expanding (1)**
- (d) What is meant by the term, 'Big Bang'? (3 marks) **the universe began from a single point (1) in the past (1) and has been expanding since (1)**



EXAM STYLE QUESTIONS - SOLUTIONS (2)

(2) Stars have been observed in our galaxy (the Milky Way) that orbit around other stars show both red and blue shifted line spectra, depending on when measurements are made.

(a) Suggest why these stars show changing Doppler shifts over time.

At some points they are moving toward Earth and sometimes away (1) toward = blue shift (1) away = red shift (1)

A nearby galaxy, Andromeda, is blue shifted.

(b) Suggest what this measurement shows about Andromeda and what could be causing this result. **The galaxy is moving towards Earth (1) by gravitational attraction (1)**

