



GCSE

4781/03



S15-4781-03

SCIENCE B

UNIT 1: Space, Energy and Life

**Pre-Release Article for use in the following
examinations on 5 June 2015:**

GCSE Science B foundation tier (4781/01)

GCSE Science B higher tier (4781/02)

4781
030001

Information for Teachers

The pre-release sets the scene for the questions in **Section B** of the foundation tier and **Section A** of the higher tier. Questions will be based around pre-release and related specification content. There will be an emphasis on data handling/analysis in this section. The questions on the pre-release will be common between the two tiers. These questions will be worth 24 marks.

No recall or terminology is required over and above that in the specification.

Students will be expected to have discussed and studied the article together with relevant specification content prior to the examination. However, they will not be expected to memorise any part of it as a clean copy will be provided with the examination paper.

Pre-Release Article

Evolution of the structure and composition of the universe

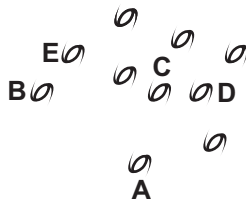
The universe is believed to have started about 13.5 thousand million years ago.

Theories about the origin of the universe have changed over time. The Steady-State theory proposed by Fred Hoyle in 1948 was widely accepted for many years. New evidence supports the Big Bang theory.

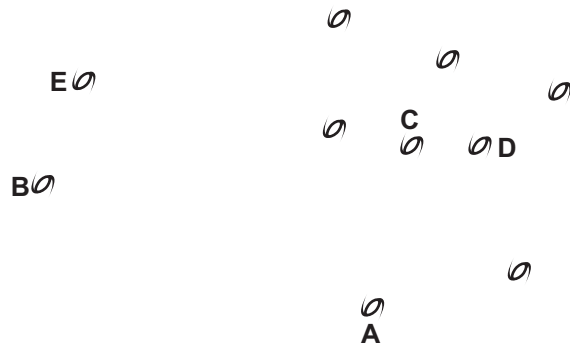
The drawings below show the same group of galaxies at two different times during the history of the universe.

Diagram 1

Early Universe



Universe at a later time



Classifying galaxies

Edwin Hubble proposed a method of classifying galaxies. The classes of galaxies are shown in **Diagram 2**.

Diagram 2

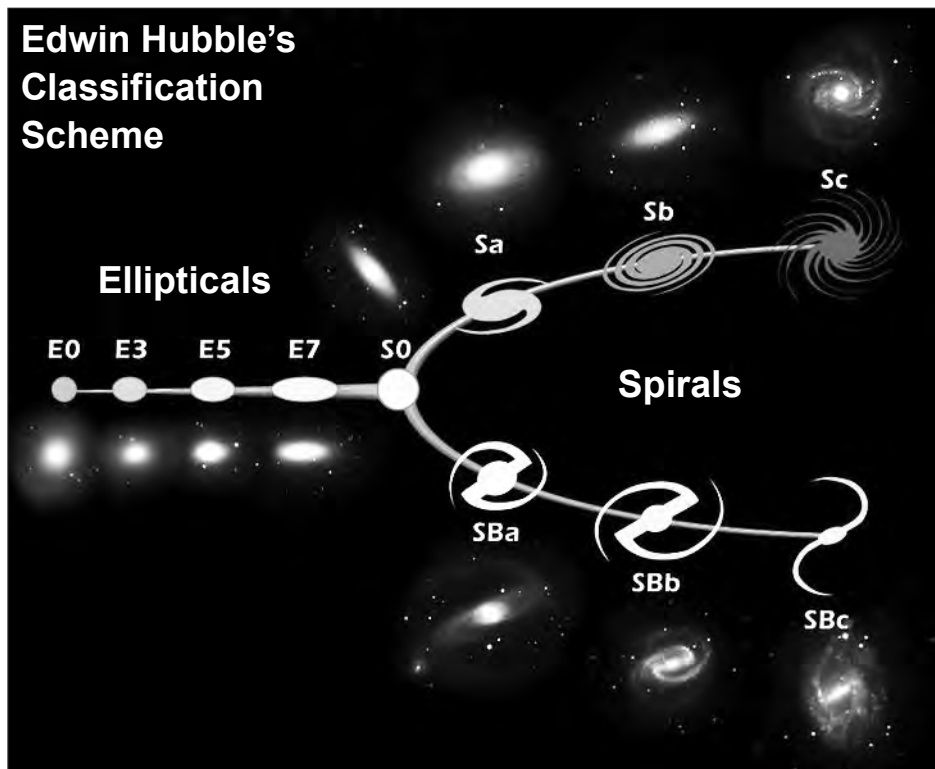


Table 1 gives the type of galaxy for different symbols used in classifying galaxies.

Table 1

Class of galaxy	Type of galaxy
E	elliptical
S0	lenticular
S	spiral
SB	barred spiral
a	tight arms & large bulge
b	intermediate arms
c	open arms & small bulge
Irr	irregular

Types of galaxies

Spiral galaxies are made up of a flattened disk containing spiral arms, a bulge at its centre, and a halo. Spiral galaxies have a variety of shapes and are classified according to the size of the bulge and tightness and appearance of the arms. The spiral arms, which wrap around the bulge, contain numerous young blue stars and lots of gas and dust. Stars in the bulge tend to be older and redder. Yellow stars like our Sun are found throughout the disk of a spiral galaxy. These galaxies rotate.

Barred spiral galaxies are spiral galaxies that have a bar running across the centre of the galaxy.

Elliptical galaxies do not have a disk or arms. Instead, they have a smooth, ball-shaped appearance. Elliptical galaxies contain old stars, and possess little gas or dust. They are classified by the shape of the ball. The stars in elliptical galaxies do not revolve around the centre in an organized way.

Irregular galaxies are galaxies that are neither spiral nor elliptical. They tend to be smaller objects that are without definite shape. They have newer stars mixed with lots of gas and dust in the interstellar space. These galaxies often have active regions of star formation. Sometimes the irregular shape of these galaxies results from interactions or collisions between galaxies.

The speed of galaxies

In 1921, astronomer Edwin Hubble measured the speeds of galaxies at different distances from Earth. The table shows similar data for recently measured galaxies.

Table 2

Galaxy	Distance from Earth (Mpc)	Speed (km/s)
NGC-5357	0.45	200
NGC-3627	0.9	650
NGC-5236	0.9	500
NGC-4151	1.7	960
NGC-4472	2.0	850
NGC-4486	2.0	800
NGC-4649	2.0	1090
NGC-1832	31.0	2000
NGC-6217	49.0	1260
NGC-7469	65.0	4470
NGC-5548	67.0	5270

The distances are given in megaparsecs (Mpc).

One megaparsec equals 3.26 million light years.

The speed of light is 300 000 km/s.

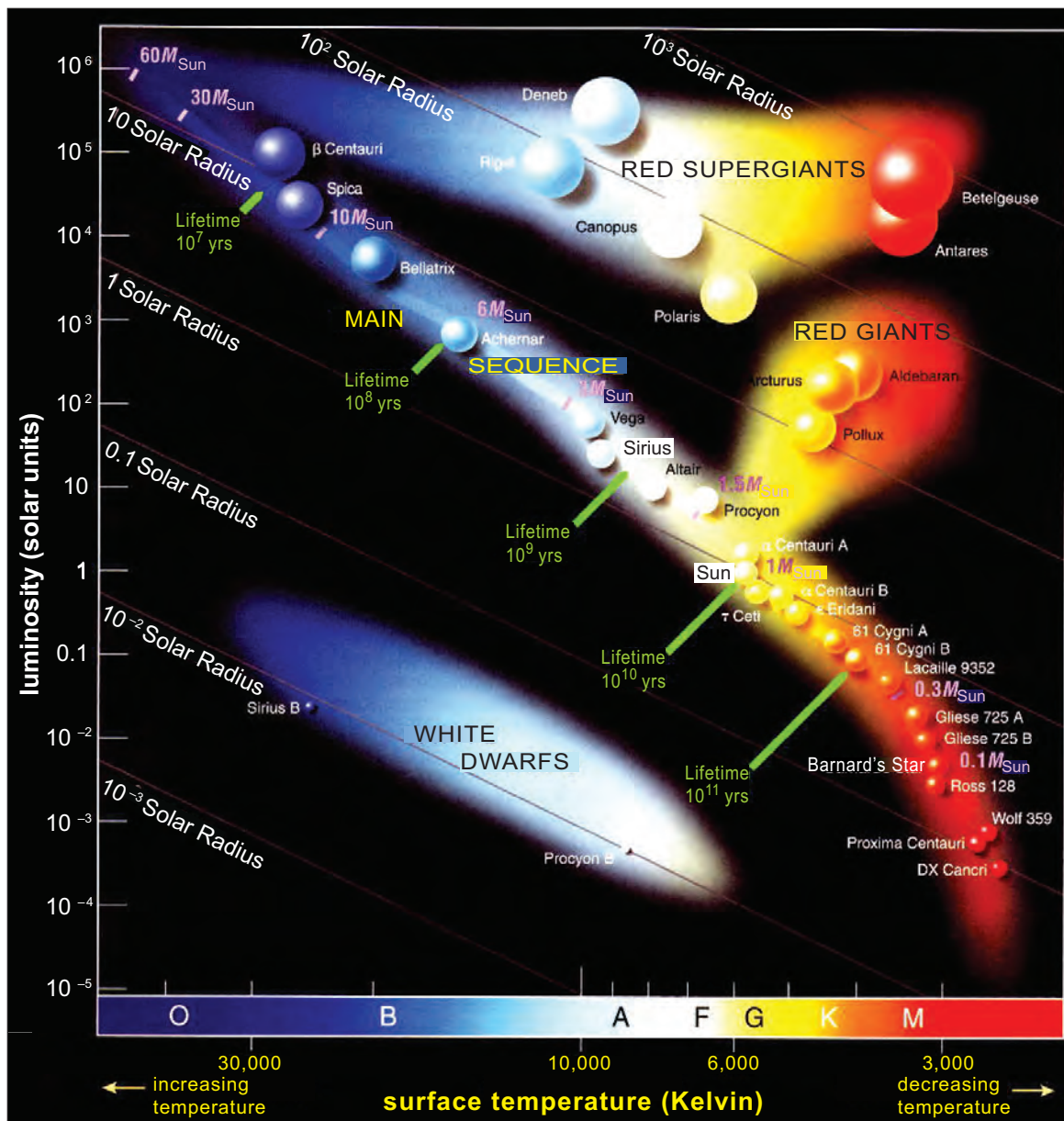
Hubble's Constant can be determined by plotting this data on a graph and finding the gradient of the best fit line that goes through the origin.

The contents of galaxies

Each galaxy contains billions of stars in different stages of their lives. The H-R (Hertzsprung-Russell) diagram (**Diagram 3**) shows stars at these different stages. The sequence of a star through the regions of the H-R diagram depends on their size.

The **H-R diagram** is a scatter graph of stars showing the relationship between the stars' luminosities and their colour classifications (O, B, A, F, G, K & M) which depends upon the surface temperature.

Diagram 3



Adapted Sources:

Diagram 1

<http://amazing-space.stsci.edu/resources/explorations.glazies-galore/index.html>

Diagram 2

http://en.wikipedia.org/wiki/Galaxy_morphological_classification

Table 2

<http://spacemath.gsfc.nasa.gov>

Diagram 3

<http://zebu.uoregon.edu/~imamura/122/lecture-5/lecture-5.html>



GCSE

4781/03-A



S15-4781-03A

SCIENCE B

UNIT 1: Space, Energy and Life

Resource Folder (Pre-Release Article)

For use with:

GCSE Science B (UNIT 1) **Section B** of the Foundation Tier

GCSE Science B (UNIT 1) **Section A** of the Higher Tier

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Pre-Release Article

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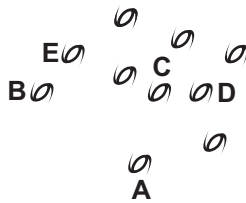
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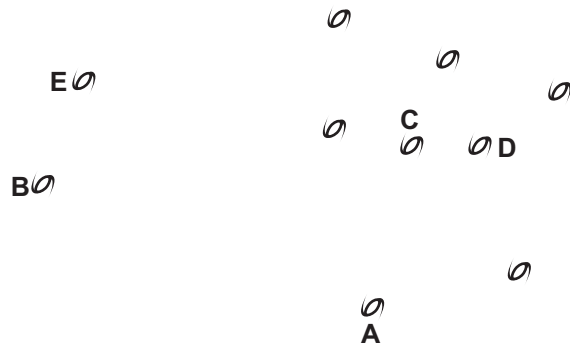
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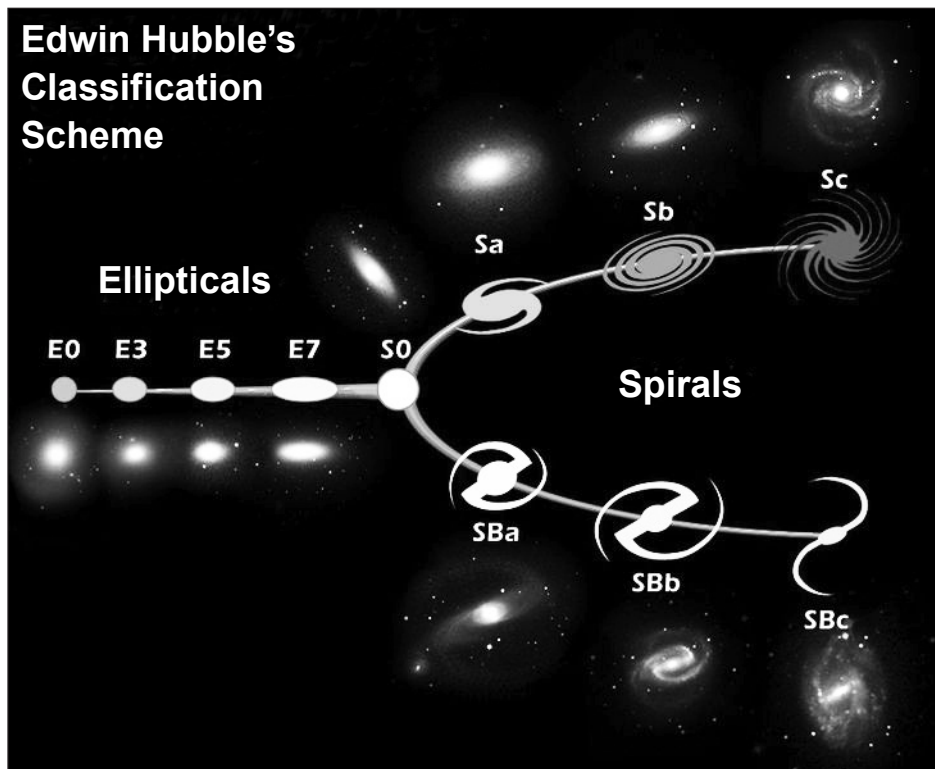


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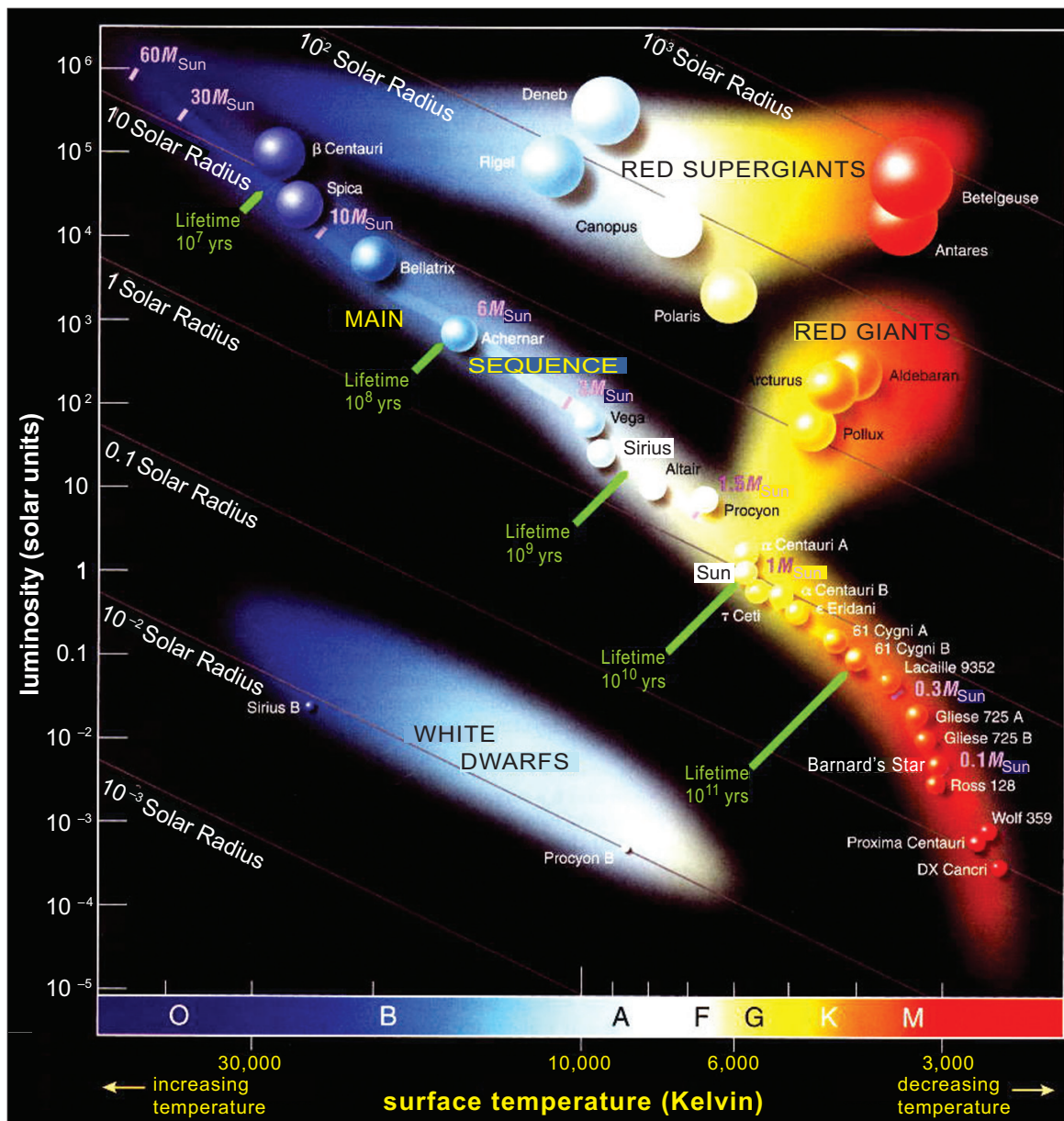
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