Big Bang: evidence and model limits

Student activity • observation and reasoning

YEAR 11 / LESSON 112 / PHYSICS ONLY

The question

How do expansion evidence and background radiation support a hot, dense early universe?

Construct an evidence-and-explanation argument using original schematic diagrams, not a tabletop explosion.

Equipment

- Booklet, original schematic evidence cards and ruler

Desk-based evidence discussion. No explosions, flames, balloons, microwave equipment or radiation sources are used.

Course coverage: Physics only: 8.13P–8.14P. Past evolution of the universe, redshift and cosmic microwave background.

Plan, model or apparatus sketch

Draw a labelled expansion or evidence diagram and identify what it does not represent.

Method and reasoning

Read the whole sequence before starting

YEAR 11 / LESSON 112 / PHYSICS ONLY

1. Write the Big Bang model as an evolving universe that was hotter and denser in the past and has expanded and cooled. Do not describe it as an explosion from one central point into pre-existing empty space.

2. Use the general redshift–distance trend to explain evidence for expansion on large scales. Distinguish the trend from every nearby galaxy having a redshift.

3. Describe the cosmic microwave background as relic radiation now observed with an approximately 2.7 K thermal spectrum, arriving from all directions with small variations.

4. Explain that the universe became transparent to this light roughly 380000 years after the early hot phase. Expansion stretches its wavelengths; the CMB is not light emitted at the very first instant.

5. Make a two-column argument linking each observation to a prediction of a hot, dense expanding model. Distinguish evidence supporting a model from an answer to every question about an ultimate beginning.

6. Evaluate a schematic expansion picture: its arrows and colours represent relationships, not a photograph of a cosmic centre or a literal outside boundary. Write one supported conclusion and one limitation.

Cleanup

- Retain the evidence argument and collect cards.

Record your evidence

Blank spaces are for your own work

YEAR 11 / LESSON 112 / PHYSICS ONLY

Reference and task data

The background temperature and transparency time are rounded reference values, not classroom measurements. The Big Bang model explains later evolution from an early hot dense state; this lesson does not claim to resolve what caused it or what preceded it.

Evidence / statement	What it supports	Limitation
Redshift trend		
CMB thermal spectrum		
Early hot dense state		
Model / diagram		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

YEAR 11 / LESSON 112 / PHYSICS ONLY

1. Name the two principal evidence strands in this lesson.

2. What does the broad redshift trend support?

3. What is the CMB?

4. What is its approximate present thermal temperature?

5. Is it light from the exact first instant?

6. Does the model require a special central location in space?