

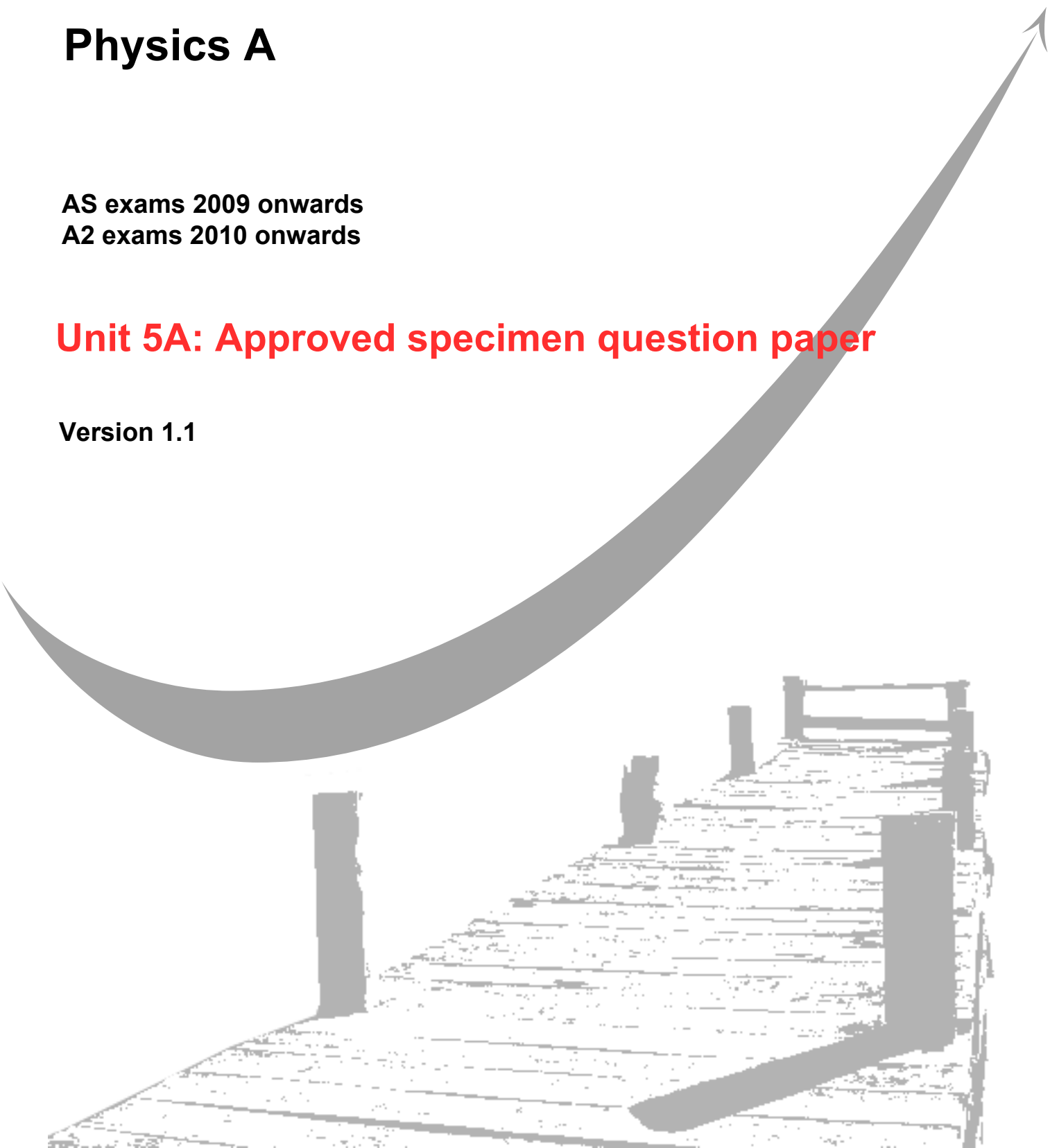
GCE
AS and A Level

Physics A

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 5A: Approved specimen question paper

Version 1.1



Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
2010
Advanced Examination



version 1.1

PHYSICS A
Unit 5A Astrophysics

PHA5A

Section B

SPECIMEN PAPER

Time allowed: 50 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- *A Data and Formula Booklet* is provided as a loose insert.

Information

- The maximum mark for this paper is 35.
- The marks for the questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers. You will be assessed on your quality of written communication where indicated in the question.

For Examiner's Use			
Number	Mark	Number	Mark
1		5	
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3			
4			
Total (Column 1)			
Total (Column 2)			
TOTAL			
Examiner's Initials			

Section B

The maximum mark for this section is 35 marks. You are advised to spend approximately 50 minutes on this section.

- 1 A converging lens can be used to produce both a magnified real image and a magnified virtual image of an object.

- (a) Draw ray diagrams to show how each image are formed. Label the principal foci of the lens in each case.

(4 marks)

- (b) Calculate the object distance required to produce a magnified image 0.25 m from a lens of focal length 0.10 m where the image is virtual.

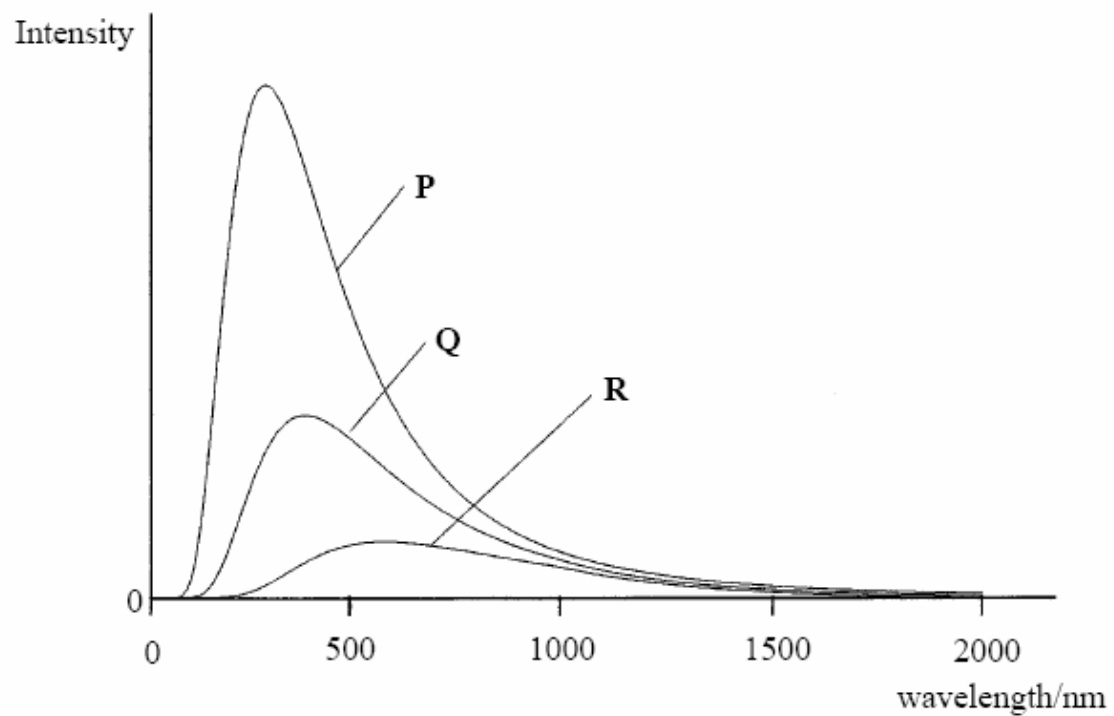
Object distance =

(2 marks)

Total 6 marks

- 2 **Figure 1** shows the black body radiation curves for three stars, labelled P, Q and R.

Figure 1



- (a) (i) State and explain, without calculation, which one of these three stars is the hottest.

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- (ii) Calculate the black body temperature of the hottest star.

Temperature =
(3 marks)

(b) More detailed analysis of the hottest star's spectrum revealed the presence of Hydrogen Balmer absorption lines.

(i) For which two spectral classes are these lines the prominent feature?

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(ii) Describe how these absorption lines are produced in the spectrum of a star.

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(4 marks)

Total 7 marks

- 3 Modern astronomy relies on the analysis of radiation from many different parts of the electromagnetic spectrum. Compare the main features of telescopes used to detect radio waves with those of optical reflecting telescopes. Explain the differences in their resolving and collecting powers.

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(6 marks)
Total 6 marks

- 4 (a) Define the *absolute magnitude* of a star.

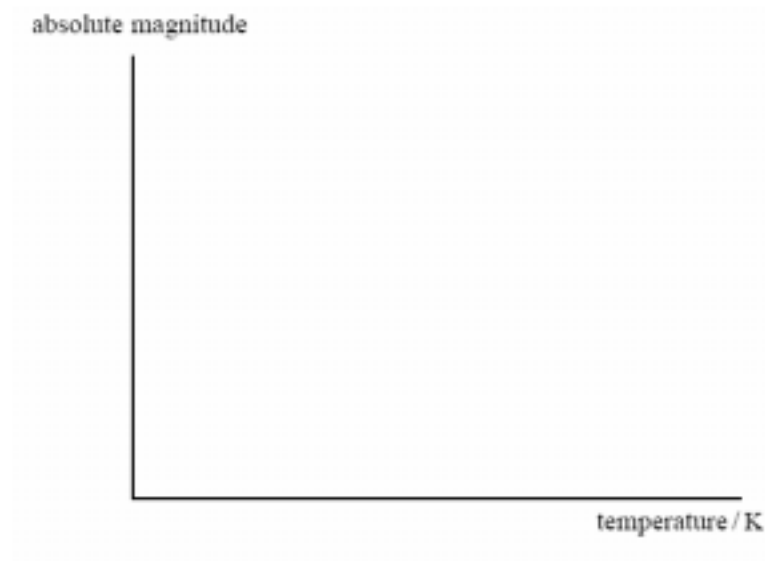
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(1 mark)

- (b) **Figure 2** shows the axes of a Hertzsprung-Russell (H-R) diagram.

Figure 2



- (i) On each axis indicate a suitable range of values.
- (ii) Label with an S the current position of the Sun on the H-R diagram.
- (iii) Label the positions of the following stars on the H-R diagram:
 - (1) star W, which is significantly hotter and brighter than the Sun.
 - (2) star X, which is significantly cooler and larger than the Sun.
 - (3) star Y, which is the same size as the Sun, but significantly cooler.
 - (4) star Z, which is much smaller than the Sun, and has molecular bands as an important feature in its spectrum.

(7 marks)

Total 8 marks

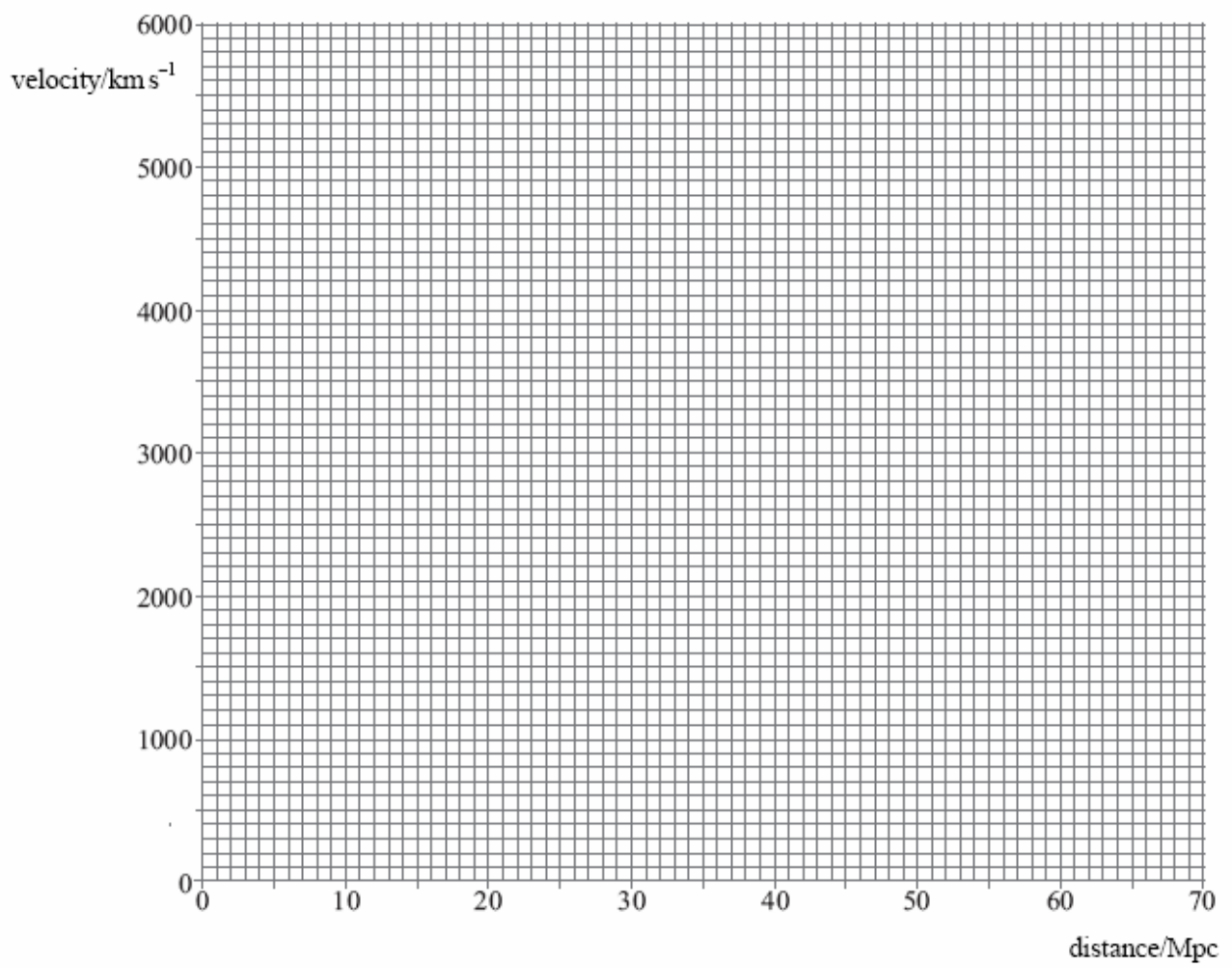
5 The red shift of a galaxy's spectrum can be used to determine its velocity, relative to the Earth.

- (a) The wavelength of the hydrogen alpha line in the spectrum of the galaxy NGXC 1357 is 660.86 nm. The wavelength of the same line from a laboratory based source is 656.28 nm. Calculate the velocity of galaxy NGC 1357.

Velocity =
(2 marks)

- (b) Use the value obtained in (a) to complete the table. Plot a graph of the data in the table and use the graph to determine a value for the Hubble constant.

galaxy	velocity/km s ⁻¹	distance/Mpc
NGC 1357		28
NGC 1832	2000	31
NGC 5548	5270	67
NGC 7469	4470	65



Hubble constant.....
(3 marks)

(c) Analysis of light from supernovae suggests that the expansion of the Universe is accelerating.

(i) Explain how the light from supernovae can be used to determine the distance to galaxies.

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(ii) What is the name given to the energy believed to be responsible for this accelerating expansion?

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(3 marks)

Total 8 marks