Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section B(SECTION 9_ ASTROPHYSICS)

Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) (i) Similarity both would appear the same brightness
As the apparent magnitudes are the same ✓
Description and explanation needed for mark.
Any references to same size gets zero for 1st mark.

Difference Kocab would appear orange / red, Polaris yellow / white
Due to their spectral classes / different temperatures ✓
Allow different colours + ref to spectral class for second mark
If colour named, should be correct.

2

(ii) Polaris is further from Earth:
Alternative:
Polaris hotter and same size

Both stars same size and Polaris is hotter ✓

As $P = \sigma AT^4$
Hence, Polaris has brighter absolute magnitude / is intrinsically brighter

Same A, would mean that Polaris has greater power output. ✓

Polaris must be further from Earth to appear same brightness as Kocab. ✓
Same apparent brightness, therefore Polaris is further away.

3

(b) (i) $v = Hd$

$v = 0.025 \times 3 \times 10^5 = 7.5 \times 10^3$ km s^{-1} ✓
1st mark is for calculating v

$d = 340 \times 10^6$ l yr = 340 / 3.26 Mpc = 104 Mpc ✓
2nd mark is for working out d in Mpc

$H = 7.5 \times 10^3 / 104 = 72$ kms^{-1} Mpc^{-1} ✓
3rd mark is for calculating H in the correct unit.

3

(ii) Age of Universe = 1 / H
1st mark is for the equation

Downloaded from www.merit-minds.com

= 0.014 × 10^6 × 3.26 × 9.5 × 10^{15} / 1000

2nd is for the answer with working

= 4.3 × 10^{17} seconds

(= 13.6 billion years)

Unit consistent with calculation.

3rd is for a time unit consistent with their answer / working

3

[11]

Q2.

(a) (i) the brightness of a star as it would appear from a distance of 10 pc ✓

1

(ii) Betelgeuse

Bellatrix is actually a lot brighter than Betelgeuse (the absolute magnitude is a lot more negative), but only appears to be a bit brighter (the apparent magnitude is only a little smaller) so Betelgeuse must be closer ✓

1

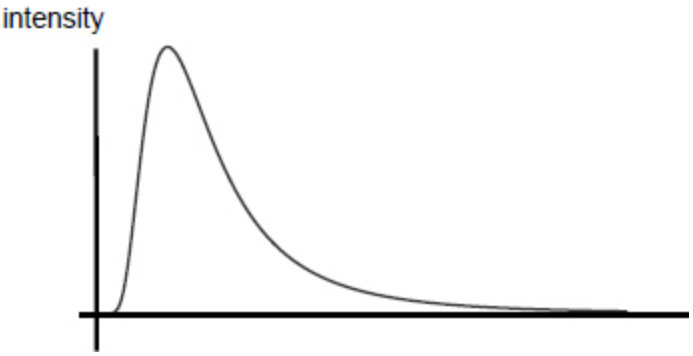
(b) (i) use of λ_{max} T = 0.0029

gives λ_{max} = 0.0029/22 000 ✓

= 1.32 × 10^{-7} (m) ✓

2

(ii)



steeper LHS than RHS ✓

intensity goes towards zero as the wavelength goes to end of axis ✓

wavelength scale with peak near 130 nm ✓

3

(c) (i) B ✓

1

(ii) helium ✓

1

(iii) temperature too low (for atmosphere of Betelgeuse to have hydrogen in n=2 state) ✓

1

[10]

Downloaded from www.merit-minds.com

Q3.

(a) use of $z = v/c$

to give $v = zc = 0.057 \times 3 \times 10^8$ ✓

$= 1.71 \times 10^7 ms^{-1} = 1.71 \times 10^4 kms^{-1}$

use of $v = Hd$

to give $d = v/H = 1.71 \times 10^4 / 65$ ✓

$= 263$ ✓ Mpc ✓

4

(b) (Strong) radio sources ✓

1

[5]

Downloaded from www.merit-minds.com