Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

(a) Star much brighter than reflected light from planet ✓

Or

Planet very small and distant – subtends very small angle compared to resolution of telescopes

1

(b) Planet and star orbit around common centre of mass that means the star moves towards/away from Earth as planet orbits ✓

1

Causes shift in wavelength of light received from star ✓

1

(c) Light curve showing constant value with dip ✓

1

When planet passes in front of star (as seen from Earth), some of the light from star is absorbed and therefore the amount of light reaching Earth reduced ✓

1

Apparent magnitude is a measure of the amount of light reaching Earth from the star ✓

1

[6]

Q2.

(a) (i) maximum distance from 1st to 5th image = 139 mm (allow 138 to 140mm) ✔

Any other correctly measured distance(s), to provide additional data, but do not allow the distance from 1st to 2nd image (as this is too small).

Alternatively allow a repeat measurement of the maximum distance for this mark. ✔

E.g. 1st to 4th image distance = 79 mm, 1st to 3rd image distance = 34 mm (allow ± 1mm on these values)

If a candidate measures distances which do not go back to the first image the initial velocity, u, will not be zero. Use of the 'suvat' equations is then considerably more complicated. A mark can still be awarded, ***provided*** *the candidate illustrates how g can be calculated* ***or*** *correctly calculates g from this value in* ***(a)(ii)****.*

If the printing process in your centre alters the scale of this diagram, measure the values on your printed papers and mark the scripts accordingly. (Send details to the moderator).

Downloaded from www.merit-minds.com

If the candidate is visually impaired and is using a modified paper that alters the scale of this diagram, measure the values on the printed paper and mark the script accordingly.

2

(ii) Evidence of correct number of time intervals to match the distance used.(e.g Using distance from 1st to 5th marble with 4 time intervals, time = 0.174 s) ✔

Value of g = 9.18 or 9.2 m s^{-2} (based on 139 mm and 0.174 s)

*Allow ecf from value of time in **(a)**,and ecf from incorrect measurements in **(b)**, but to allow ecf candidate **must** show workings of the calculation and not just state a value for g*

(Allow also 918 or 920 cm s^{-2} and 9180 or 9200 mm s^{-2}) Answer must have correct unit ✔

*Allow this mark based on a correct calculation from just one measurement of distance in **(a)(i)***

No sf penalty

2

(b) So image is sharp / less blurred / image is well defined
OR
Any answer referring to 'motion blurring'

Allow reference to 'image' or 'marble'

1

[5]

Q3.

(a) Measurement of <u>at least 30</u> fringe widths
(check that candidate has not miscounted) e.g. 30 fringe widths = 40 mm or 41 mm.

Correct answer of 1.3 or 1.4 mm quoted to 2sf with unit ✔(one mark)
OR
Correct answer 1.33 – 1.37 mm to 3sf with correct unit ✔✔ (two marks).

If candidate quotes value in range 1.33 – 1.37 mm to 3sf they achieve both the 2nd and 3rd marks (A quote to 3sf is justified in terms of uncertainty if a large number of fringe widths have been measured).

For 2nd & 3rd marks allow ecf from incorrect measurement in 1st mark.

If the printing process in your centre alters the scale of this diagram, measure the values on your printed question papers and mark the scripts accordingly. Send details to the moderator.

If a candidate is visually impaired and using a modified paper that alters the scale of this diagram, measure the values on the printed question paper and mark the script accordingly.

3

(b) 1 mark for intermediate step where candidate doesn't get correct final answer. i.e. calculating % uncertainty of total measurement (i.e. % uncertainty in w) ✔

OR for both marks:

Uncertainty in w = ± 0.03 mm ✔✔

(Full 2 marks for correct answer with unit – No unit no mark unless a correct intermediate step has been completed which will have been credited for 1 mark as explained above)

Uncertainty in measurement of multiple fringes is ± 1 mm (precision of

Downloaded from www.merit-minds.com

ruler used).
E.g. for length 41 mm ± 1 mm % uncertainty = 1/41 x 100 = 2.4 %

Uncertainty in w (single fringe)
= 2.4 x 1.4/100 = ±0.03 mm

Simply quoting 0.03 - ***NO marks***

No penalty for omission of ±

2

(c) (i) (Using w = 1.40 mm)

Wavelength = 5.60×10^{-7} m ✔

Allow ecf for value of w from ***(b)***
Consistent unit required for the mark. No sf penalty.

1

(ii) (Intermediate step) % uncertainty = 5.8% ✔

(From %uncty s = 3.3%, w = 2.4%, D = 0.1% % uncertainty in wavelength = 3.3 +2.4+0.1 = 5.8%).
Allow ecf from ***(b)***

1

(iii) (Using wavelength = 5.60×10^{-7} m)
Uncertainty in wavelength = $\pm 3.2 \times 10^{-8}$ (m) ✔ or ± 32 (nm) or $\pm 3.2 \times 10^{-5}$ (mm)

Allow ecf from ***(c)(i)*** *&* ***(ii)***
No sf penalty
If the value is consistent with the wavelength quoted in ***(c)(i)****,* ***allow the numerical answer without the unit****, otherwise a unit is required.*

1

[8]

Downloaded from www.merit-minds.com