

Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Mark Schemes

Q1.

- (a) Both focal points labelled, on the principal axis, and coincide, with $f_o > f_e$ ✓

Three off-axis rays through objective lens correct ✓

Three rays through eyepiece correct, parallel to a construction line. ✓

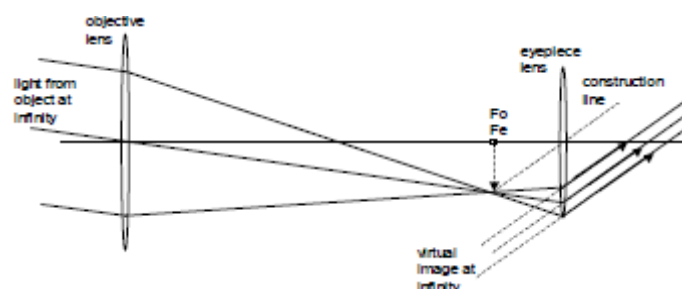
Accept point or length labelled. Allow single point F.

Ignore labels outside the space between the two lenses.

Rays must be off-axis to get the second mark.

Construction line does not need to be drawn.

If only 2 rays drawn, or there is no principal axis, max 2.



3

- (b) (i) Using
 $f_o + f_e = 21$
 $f_o / f_e = 210$ ✓

Evidence of both equations needed for the mark.

Gives

$$211 f_e = 21$$

$$f_e = 21 / 211 = 0.10 \text{ m}$$

$$\text{and } f_o = 21 \text{ m (20.9)} \quad \checkmark$$

$$\text{Alternative: } f_o = 4410 / 211 = 0.10 \text{ m}$$

If 210 used rather than 211 in substitution, max 1.

If the correct answer is obtained by inspection, max 1.

2

- (ii) Large diameter allows fainter objects to be viewed,
 (as the collecting power is proportional to d^2) ✓
 Larger diameter allows better resolution (as smallest resolvable angle is
 proportional to $1 / d$) ✓

Allow: more light, better collecting power, brighter image, able to see more distant objects (not just further).

Allow references to more detail or clearer images for this mark.

Ignore references to magnification or field of vision.

- (c) Diagram showing two focal points with blue focal point closer to lens than red focal point.

Colours must be labelled. Allow wavelengths or frequencies if correct way round.

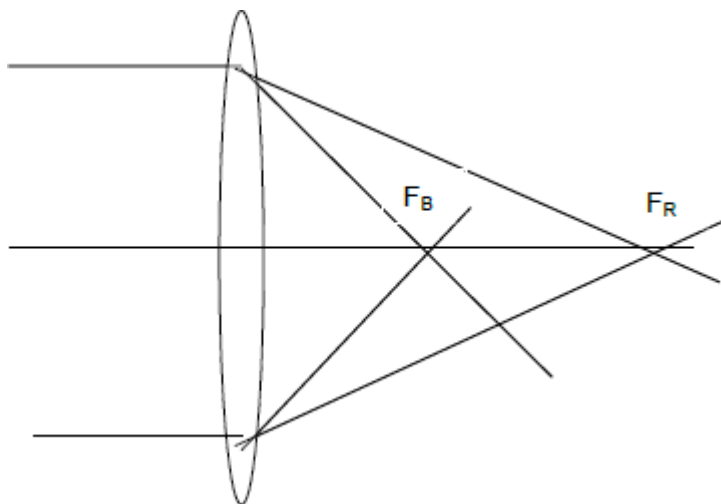
Rays need to be focused.

Allow 1 ray for each colour if principal axis drawn and foci labelled.

If other colours included, they must be correct.

Allow violet for blue.

Incident rays do not need to be parallel to the principal axis.



1

[8]

Q2.

- (a) (i) $W = 2mg \cos \phi \quad \therefore m = W/(2g \cos \phi)$ ✓

The question says show that, so the candidates must write down both steps.

1

- (ii) Well drawn straight line of best fit. ✓

The line should follow the trend of the points with an even scatter of points on either side of the line.

1

- (b) (i) Triangle drawn with smallest side at least 8 cm in length. ✓

Correct readings taken from the line for the triangle ✓

Gradient in the range 0.45 to 0.49 (0.445 to 0.494) quoted to 2 or 3 significant figures ✓

The size of the triangle can be identified from readings taken from the line.

The third mark is independent of the other two: error carried forward for incorrect readings (or for a poor line of best fit) which give a gradient out of range is not allowed.

3

- (ii) Candidate's answer for gradient in (b)(i) correctly multiplied by g (expected answer 4.6)

✓

N ✓

No s.f. penalty.

The second mark is for the unit and can be awarded if the numerical

- (c) $\delta x\% = 0.2$ and $\delta y\% = 0.5$ ✓
 $\delta(x/y)\% = \delta x\% + \delta y\% = 0.2 + 0.5 = 0.7$ ✓
 Use of $\delta(x/y)^2\% = 2 \times \delta(x/y)(\%)$ ✓

Final answer is ($\pm$) 1.4 (%) which automatically gains all three marks

Otherwise

Accept only 1 s.f. for 1st and/or 2nd marks.

The third mark is for the method, not the final answer

3

- (d) (i) Systematic errors in measurements are errors which show a pattern or a bias or a trend ✓

Some acceptable alternatives

- **A systematic error** is one which deviates by a fixed amount from the true value of a measurement
- An error which has the same value in all readings
- A difference between the true value of a quantity and the indicated value caused by a fault in the measuring device
- Accept a good example of systematic error.

1

- (ii) y would be larger ✓
 because angle θ would be smaller

or

because friction would be opposing the increasing weight of m ✓

2

[13]