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

Mark Schemes

Q1.

(a) Absolute magnitude scale gettingg more negative going up

and

Time scale with 0 along axis, going up to between 10 and 400 ✔
The first mark is for the scales

Line drawn going up and down, with LHS steeper than steepest part of RHS ✔
The second is for the curve

Line drawn increasing quickly with peak at absolute magnitude between -18 and -20 ✔
The third is for the value of the peak

3

(b) Object whose absolute magnitude is known (and whose apparent magnitude can be measured.) ✔
Do not allow fixed or constant for 'known'
But condone predictable
Do not allow 'directly measured'
Condone intrinsic or inherent brightness, or luminosity for absolute magnitude

1

(c) Measurements of supernovae do not agree with predictions (from Hubble's Law) ✔

1

So Universe must be expanding at increasing rate/accelerating ✔

1

(Controversial as) no known energy source for expansion or reference to dark energy ✔

1

[7]

Q2.

The mark scheme gives some guidance as to what statements are expected to be seen in 1 or 2 mark (L1), or 3 or 4 mark (L2) and 5 or 6 mark (L3) answer. Guidance provided in section 3.10 of the 'Mark Scheme Instructions'

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document should be used to assist in marking this question.

Mark	Criteria	QoWC
6	All three methods described. All three methods applied to Earth-like planets. Judgement reached.	The student presents relevant information coherently, employing structure, style and spg to render meaning clear. The text is legible.
5	Only two methods described and all three applied, Or All three described and only two applied.	
4	Two methods described and applied, Or three described and only one applied.	The student presents relevant information and in a way which assists the communication of meaning. The text is legible. SPG are sufficiently accurate not to obscure meaning.
3	Three methods described, Or Two methods described and one applied.	
2	Only one method described and applied Or two methods described with application.	The student presents some relevant information in a simple form. The text is usually legible. SPG allows meaning to be derived although errors are sometimes obstructive.
1	Only one method described.	
0	No relevant information.	The student's presentation, SPG seriously obstruct understanding.

Higher Level (5 or 6 marks)

All three methods of measurement are described (transit, radial and direct observation)

Problems associated with each one are discussed, with particular reference to detecting an object an Earth-like planet.

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Intermediate Level (3 or 4 marks)

Only two of the three methods are described and little effort is made to link the methods to the detection of an Earth-like planet.

Low level (1 or 2 marks)

Only one method is described, or two methods poorly.

Little or no reference is made to the detection of an Earth-like planet.

(a more detailed mark scheme will be produced with levelled statements)

***Transit** – dips in brightness as planet crosses in front of star from our point of view.*

Alignment must be correct for planets to eclipse, so many possible candidates not observed. Earth-like planet could be observed provided not too far away.

***Radial velocity** (Doppler) – periodic shift in spectra of star due to star's movement around common centre of mass with planet.*

Earth-like planet mass much less than mass of Sun-like star so effect slight. Earth-like planet could be detected with highly sensitive spectrometers.

***Direct observation** – very unlikely as Earth-like planet to small and too near star and too cool to be detected against the brightness of the Sun-like star. Unlikely to be detected.*

[6]

Q3.

(a) 0.5 mm [0.05 cm, 0.0005 m] ✔

only acceptable answers

1

(b) 8.65 mm [0.865 cm, 0.00865 m] $_1$✔

the micrometer reads zero when the jaws are closed $_2$✔

only 3sf answers are acceptable for $_1$✔

accept no <u>zero</u> error for $_2$✔

2

(c) L = (403 − 289 =) 114 mm ✔

1

(d) absolute uncertainty = 1 mm $_1$✔

percentage uncertainty = $\frac{1}{114} \times 100 = 0.88\%_2$✔

accept 2 mm for ab. uncertainty $_1$✔

allow ecf for wrong L and / or wrong ΔL

accept 1.75%

2

(e) should move wire directly over / closer to scale on the ruler to avoid <u>parallax</u> error ✔

both statement and explanation required for this mark

1

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(f) five values of *R*/*L* correct, recorded to 3 sf [last row to 3sf or 4sf]; accept values in Ω cm^{-1} ✔

mean based on <u>first four</u> rows only; result 9.94 Ω m^{-1} [9.94 × 10^{-2} Ω cm^{-1}] ✔

L/cm	*R/Ω*	*(R/L)Ωm^{-1}*
81.6	*8.10*	*9.93*
72.2	*7.19*	*9.96*
63.7	*6.31*	*9.91*
58.7	*5.85*	*9.97*
44.1	*4.70*	*10.66 (10.7)*

2

(g) cross-sectional area = $\frac{\pi d^2}{4}$ $_1$✔

resistivity from $\frac{R}{L} \times A$, correct substitution of result from 01.6 $_2$✔

1.10 × 10^{-6}3 ✔

Ω m $_4$✔

resistivity from $\frac{R}{L} \times \frac{\pi d^2}{4}$ *earns* $_{12}$✔✔

allow $_2$✔ *if* $\frac{R}{L}$ *value is not based on mean or on a mean from all five rows of table in 01.6*

condone 1.12 × 10^{-6} for $_3$✔ *if fifth row in 01.6 was not rejected*

withhold $_3$✔ *for POT error*

4

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