**Mark schemes**

Q1.

X-rays

for 1 mark each

[3]

Q2.

(a) ray shown refracted (to rhs or along normal)

gains 1 mark

 but

ray shown refracted away from normal

gains 2 marks

2

(b) idea that

travels at a different speed

gains 1 mark

 (allow refracted / travels slower in air / air is less dense) (do not allow bent)

 but

travels more quickly in air

gains 2 marks

2

[4]

Q3.

(a) (i) a horizontal distance indicated and labelled

gains 1 mark

 but

horizontal distance indicated between identical points on

adjacent waves (to within 3-4mm) and labelled

gains 2 marks

2

(ii) peak ↔ trough indicated\*

gains 1 mark

 but

peak / trough ↔ mean indicated\*

 (\* to within 1-2mm either end)

gains 2 marks

(allow 1 mark if both lines unlabelled or 2 marks if both lines

accurately drawn and unlabelled)

2

(b) • 1.5

• hertz / Hz or (waves / cycles) per second

for 1 mark each

(do not allow wavelength / hertz per second)

2

[6]