MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P6 - TEST 4

WAVES

Intermediate

www.examqa.com

1. (a) P waves are longitudinal and S waves are transverse

1

(b) 0.4

1

(c) wave speed = frequency × wavelength

allow $v = f\lambda$

1

(d) 7200 = 0.4 × wavelength

1

$$\text{wavelength} = \frac{7200}{0.4}$$

1

wavelength = 18 000 (m)

allow up to full marks for ecf using their answer to part ***(b)***

a method shown as
7200 × 2.5 = 18 000
scores ***0*** *marks*

1

an answer 18 000 scores ***3*** *marks*

(e) Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.

2

[8]

2.

Level 3 (5–6 marks):
A detailed and coherent plan covering all the major steps is provided. The steps in the method are logically ordered. The method would lead to the production of valid results.

A source of inaccuracy is provided.

Level 2 (3–4 marks):
The bulk of a method is described with mostly relevant detail. The method may not be in a completely logical sequence and may be missing some detail.

Level 1 (1–2 marks):
Simple statements are made. The response may lack a logical structure and would not lead to the production of valid results.

0 marks:
No relevant content.

Indicative content

place a glass block on a piece of paper

draw around the glass block and then remove from the paper

draw a line at 90° to one side of the block (the normal)

use a protractor to measure and then draw a line at an angle of 20° to the normal

replace the glass block

using a ray box and slit point the ray of light down the drawn line

mark the ray of light emerging from the block

remove the block and draw in the refracted ray

measure the angle of refraction with a protractor

repeat the procedure for a range of values of the angle of incidence

possible source of inaccuracy

the width of the light ray

which makes it difficult to judge where the centre of the ray is

[6]

3.

(a) (i) 20

1

20 000

either order

accept ringed answers in box

1

(ii) (frequency) above human range

accept pitch for frequency

or

(frequency) above 20 000 (Hz)

*do **not** accept outside human range*

*allow ecf from incorrect value in **(a)(i)***

1

(iii) any **one** from:

- pre-natal scanning

  accept any other appropriate scanning use

  *do **not** accept pregnancy testing*
- removal / destruction of kidney / gall stones
- repair of damaged tissue / muscle

  accept examples of repair, eg alleviating bruising, repair scar damage, ligament / tendon damage, joint inflammation

  accept physiotherapy

  accept curing prostate cancer or killing prostate cancer cells
- removing plaque from teeth

  cleaning teeth is insufficient

1

(b) 7.5×10^{-4} (m)

*$1.5 \times 10^3 = 2.0 \times 10^6 \times \lambda$ **gains 1** mark*

2

(c) for reflected waves

must be clear whether referring to emitted or detected / reflected waves

if not specified assume it refers to reflected wave

any **two** from:

- frequency decreased
- wavelength increased
- intensity has decreased

  allow amplitude / energy has decreased
  allow the beam is weaker

2

[8]

4. (a) any **two** correct construction lines:

if more than 2 construction lines treat as a list

2

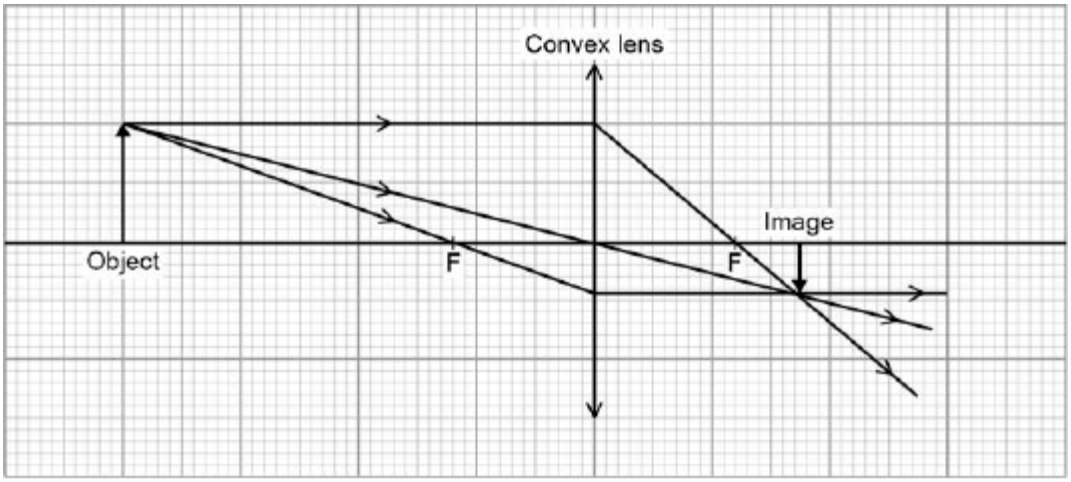
- line passing straight through centre of lens (& out other side)
- line travelling parallel to principal axis & then being refracted through principal focus (on RHS)
- line travelling through principal focus (on LHS) & then being refracted to be parallel to principal axis (on RHS)

inverted image drawn (with arrow) in correct location

1

one arrowhead from object to image on any construction ray

conflicting arrowheads negate this mark



1

(b) any **two** from:

- inverted

  accept upside down

- real
- diminished / smaller

  *allow ecf if ray diagram wrongly drawn but descriptions must relate to **their image***

  a converse negates mark, eg real and virtual scores zero

2

[6]

5. (a) converging (lens)

accept 'con vex (lens)'

accept biconvex

1

(b) (principal) foci

accept 'focus' / 'focuses' / 'focis'

focal point(s)

1

(c) (i) formed where (real) rays (of light) intersect / meet / cross

accept rays (of light) pass through the image

accept 'image is on the opposite side (of the lens to the object)'

accept (construction) lines cross over

a response relating to a screen or similar is neutral

lines are solid and not dotted is neutral

1

(ii) inverted

accept any unambiguous correct indication

1

(d) (i) smooth curve which matches the points

*judge by eye but do **not** accept point to point by ruler or otherwise*

1

(ii) continuous

1

(iii) as distance increases, magnification decreases

accept negative correlation

*a statement 'inversely proportional' is incorrect and limits maximum mark for this part question to **1***

1

further detail eg magnification falls steeply between 40 and 50 cm
or
magnification begins to level out after / at 70 cm

1

[8]

6. (a) (i) microwaves

1

(ii) can pass through the ionosphere

accept travels in a straight line

accept atmosphere for ionosphere

*do **not** accept air for ionosphere*

1

(b) higher the frequency, further the wave travels
(into the atmosphere before reflection)

1

(c) 15 000

*allow **1** mark for correct transformation and substitution*

ie $\frac{300\,000\,000}{20}$

*an answer of 15 000 000 only gains **1** mark*

allow both marks for an answer of 15 MHz (unit must be changed)

an answer of 15 gains no credit

2

[5]

7. (a) number of complete vibrations per second

for 1 mark

1

(b) (i) correct trace (more waves), *ignore amplitude*

for 1 mark

1

(ii) correct trace (higher amplitude), *ignore frequency*

for 1 mark

1

(c) (i) higher

for 1 mark

1

(ii) quieter

for 1 mark

1

[5]

8. (a) Reflection correct
Normal incidence correct in and out
Correct refraction in
Parallel ray out

each for 1 mark

4

(b) (i) Each ray correctly refracted in

1 + 1 = 2

7

(ii) Wavefronts perp sides
Wavefronts closer

(Cannot score wavefront marks if refracted rays clearly wrong)

(iii) Speed reduces
Starting at B
Then D

each for 1 mark

(c) TIR correct

gets 2 marks

Else rough reflection

gets 1 mark

2

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9. (a) microphone

1

(c) (i) vertical line from any maxima or minima to axis

*do **not** penalise minor errors but*

*do **not** allow unless intention is clear*

1

(ii) loudness / volume / intensity / energy

*do **not** accept noise*

1

(c) 17

this answer only

1

(d) the greater the distance, the smaller the amplitude

accept volume / intensity / energy / loudness for amplitude

or

there is a (strong) negative correlation between distance and amplitude

or

there is an inverse square relationship between distance and amplitude

*do **not** accept distance and amplitude are inversely proportional*

1

(e) 20 Hz

either order

1

20,000 Hz

accept 20 kHz provided unit has been clearly changed

1

[7]