

MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P6 - TEST 5

WAVES

Advanced

Mark schemes

1.	(a) (i) frequency	1
	wavelength	1
	(ii) 10^{-15} to 10^4	1
(b)	2.0×10^5	
	<i>correct substitution of</i> <i>$3.0 \times 10^8 / 1500$ gains 1 mark</i>	2
	Hz	1
(c) (i)	(skin) burns	1
	(ii) skin cancer / blindness	1
(d) (i)	any one from: <ul style="list-style-type: none">• (detecting) bone fractures• (detecting) dental problems• treating cancer	1
	(ii) any one from: <ul style="list-style-type: none">• affect photographic film• absorbed by bone• transmitted by soft tissue• kill (cancer) cells <i>answer must link to answer given in (d)(i)</i>	1
(iii)	$9 / 36 = 0.25$ $0.5 / 2 = 0.25$ $4 / 16 = 0.25$ <i>accept:</i> $36 / 9 = 4$ $2 / 0.5 = 4$ $16 / 4 = 4$	2

conclusion based on calculation

two calculations correct with a valid conclusion scores 2 marks

one correct calculation of k scores 1 mark

1

[13]

2.

- (i) (partly) reflected when they hit a (boundary between two) different media or substance or tissue

accept named substances

do not accept bounce back

1

time taken for reflected wave (to return) is used to produce the image

1

- (ii) any **one** from:

cleaning a delicate mechanism / jewellery

do not accept cleaning

welding plastics

cutting textiles

mixing emulsion paints

sonar

motion sensors (in burglar alarms)

do not accept burglar alarms

removing dental plaque

industrial quality control

breaking up kidney stones

treating injuries

1

[3]

3.

- (a) light (inside the tin can) is reflected many times before incident on the hole

1

at each reflection energy / light is absorbed so (very) little light / energy leaves the hole

1

(b) the object absorbs all of the radiation incident on it
or
the object does not reflect or transmit any radiation
or
the object is the best possible emitter of radiation

1

(c) the intensity of every wavelength increases

1

the shorter the wavelength the more rapid the increase in intensity

1

the peak intensity occurs at shorter wavelength

1

(d) accept any value between 1600 (°C) and 10 000 (°C)

1

(e) the temperature has increased

1

as 200 years ago the energy / radiation from space = energy /
radiation emitted (and reflected) into space

1

but now less radiation is emitted so there is a net absorption
allow energy for radiation

1

[10]

4.

(a) C or 0.18 mm

1

(b) 0.6 m

allow 1 mark for correct transformation and substitution

allow 1 mark for changing frequency to Hz

answer 600 gains 1 mark

2

(c) creates an alternating current

accept 'ac' for alternating current

accept alternating voltage

1

with the same frequency as the radio wave

accept signal for radio wave

or it gets hotter

1

- (d) X-rays cannot penetrate the atmosphere
accept atmosphere stops X-rays
*do **not** accept atmosphere in the way*

or X-rays are absorbed (by the atmosphere)
before reaching Earth
ignore explanations

1

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5.

- (a) (i) radio(waves)

1

- (ii) energy

correct answer only

1

- (b) (i) 0.0125 (m)

allow 1 mark for correct transformation and substitution

2

- (ii) make it hot(ter)

*do **not** accept cook it*

accept (air) particles inside ball will move faster

accept water in the ball gets hotter

1

[5]

6.

(a) (i) any **two** from:

- travel at the same speed (through a vacuum)
accept travel at the speed of light
accept air for vacuum
- can travel through a vacuum / space
do not accept air for vacuum
- transfer energy
- can be reflected
- can be refracted
- can be diffracted
- can be absorbed
- can be transmitted
- transverse
accept any other property common to electromagnetic waves
accept travel at the same speed through a vacuum for both marks
do not accept both radiated from the Sun

2

(ii) infra red

both required for the mark

radio(waves)

accept IR for infra red

1

(b) 2 400 000 000

correct transformation and substitution gains 1 mark

ie $\frac{300000000}{0.125}$ or $\frac{300000000}{0.125}$

an answer of 24 000 000 gains 1 mark

either 2 400 000 kHz

or 2 400 MHz scores **3** marks but the symbol only scores the 3rd mark if it is correct in every detail

2

hertz

accept Hz

do not accept hz

1

(c) (i) presented (scientific) evidence / data

do an experiment / investigation is insufficient

1

- (ii) to find out if there is a hazard (or not)
accept to find out if it is safe
accept not enough evidence to make a decision
not enough evidence is insufficient

1

[8]

7.

- (a) any **two** from:

- travel (at same speed) through a vacuum / space
*do **not** accept air for vacuum*
- transverse
- transfer energy
- can be reflected
- can be refracted
- can be diffracted
- can be absorbed
- travel in straight lines

2

- (b) can pass through the ionosphere

accept atmosphere for ionosphere
*do **not** accept air for ionosphere*
accept travel in straight lines
accept not refracted / reflected / absorbed by the ionosphere

1

- (c) $v = f \times \lambda$

$$1.2 \times 10^6 / 1200\ 000$$

allow 1 mark for correct substitution
ie $3.0 \times 10^8 = f \times 2.5 \times 10^2$

2

hertz / Hz

*do **not** accept hz **or** HZ*
*accept kHz **or** MHz*
*answers 1.2 MHz **or** 1200 kHz gain all 3 marks*
for full credit the unit and numerical value must be consistent

1

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8.

- (a) (i) to check rise in temperature (of other thermometers) was due to the (different wavelengths of) light

accept as a control / comparison

to measure room temperature is insufficient

1

- (ii) any **two** from three:

- different colours produce different heating effects / (rises in) temperatures
- red light produces the greatest heating effect / (rise in) temperature

or

- violet produces the least heating effect / (rise in) temperature
- all colours produce a greater heating effect than outside the spectrum

an answer

the longer the wavelength the greater the (rise in) temperature

or

the lower the frequency the greater the (rise in) temperature gains both marks

2

- (b) move a thermometer into the infrared region / just beyond the red light

allow use an infrared camera / infrared sensor

1

the temperature increases beyond 24(°C)

accept temperature higher than for the red light

1

- (c) $v = f \times \lambda$

$$9.4 \times 10^{-6}$$

accept 9.375×10^{-6} or 9.38×10^{-6}

or

$$0.0000094$$

accept 0.000009375

or 0.00000938

allow 1 mark for correct substitution

ie $3 \times 10^8 = 3.2 \times 10^{13} \times \lambda$

2

- (d) at night the surroundings are cooler
accept at night the air is colder
there is no heat from the Sun is insufficient

or

at night there is a greater temperature difference between people and surroundings

1

(so surroundings) emit less infrared (than in daytime)

accept camera detects a greater contrast

or

gives larger difference in infrared emitted (between people and surroundings)

1

[9]

9.

- (a) C or 0.18 mm

1

- (b) 0.6 (m)

*allow 1 mark for correct substitution and/or transformation **or** 1 mark for changing frequency to Hz*
answer 600 gains 1 mark

2

- (c) creates an alternating current

accept 'ac' for alternating current
accept alternating voltage

1

with the same frequency as the radio wave

accept signal for radio wave

accept it gets hotter for 1 mark provided no other marks scored

1

- (d) X-rays cannot penetrate the atmosphere

accept atmosphere stops X-rays

*do **not** accept atmosphere in the way*

or

X-rays are absorbed (by the atmosphere) before reaching Earth

ignore explanations

1

[6]

10.

(a) (i) converging / convex / biconvex

1

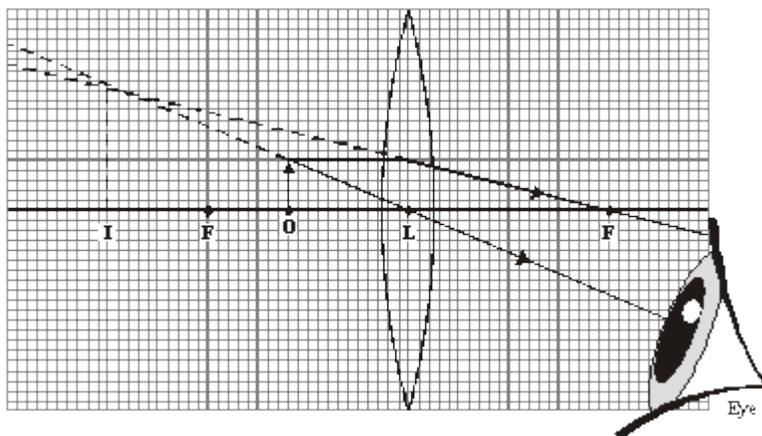
(ii) focal (points) **or** foci
accept focuses **or** focus (point)

1

(iii) (principal) axis

1

(iv)



all lines drawn with a ruler for full marks

no ruler, penalise 1 mark from first four

last mark can still be awarded

double refraction drawn could get 4 out of 5 marks

ray that continues from the top of the object through L to the eye

1

horizontal ray from the top of the object, refracted by the lens and continued through F on the r.h.s. to the eye

1

back projections of these rays (shown as dotted lines)

1

*image 25 mm high at 61 mm left of L
(tolerance 1 mm ± vertically, 2 mm ± horizontally)*

1

*at least one arrow shown on real ray and towards the eye
but do **not** credit if contradicted by other arrow(s)*

1

(v) formed where imaginary rays intersect / cross **or** not formed by real rays

*accept (virtual image) is imaginary
accept cannot be put on screen
do **not** credit just '... is not real'*

1

(b) (the image) needs to fall on film / sensors / LDRs / CCDs

accept just 'charged couples'

*do **not** credit '... solar cells'*

*do **not** accept virtual image cannot be stored*

1

either to cause a (chemical) reaction **or** to be digitalised

for credit response must be appropriate to camera type

1

object (should be) on the far side of F / the focus (from the lens)

***or** ... more than the focal length (away from the lens)*

allow 'beyond the focus'

or object should be more than twice the distance / 2F (from the lens) (2 marks)

***or** ... more than twice the focal length (away from the lens)*

(2 marks)

1

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