Mark schemes

Q1.

(a) Milky Way

1

(b) dust and gas

1

(c) gravitational force

1

(d) fusion

1

(e) visible light takes the same time as infrared radiation

1

(f) greater

1

(g) greater rate than the Earth

1

the Sun is at a higher temperature

allow the Sun has a greater surface area

MP2 is dependent on MP1

1

[8]

Q2.

(a) infrared camera

allow thermometer, thermal imaging camera, night vision goggles

1

(b) 690 nm

1

(c) bees cannot detect all the colours (a human can)

1

bees can detect UV radiation (but humans can't)

allow bees cannot detect red (light but humans can)

1

(d) reflected

1

absorbed

this order only

1

(e) black

1

(f) diffuse

1

[8]

Q3.

(a) 1 (°)

1

(b) **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

Some indicative content could be indicated within a labelled diagram

- place a glass block on a piece of paper
- draw around the glass block
- use the ray box to shine a ray of light through the glass block
- mark the ray of light entering the glass block
- mark the ray of light emerging from the glass block
- join the points to show the path of the complete ray through the block
- and draw a normal line at 90 degrees to the surface
- use a protractor to measure the angle of incidence
- use a protractor to measure the angle of refraction
- use a ray box to shine a ray of light at a range of different angles (of incidence)
- increase the angle of incidence in 10 degree intervals
- from an angle of incidence of 10 degrees to an angle of incidence of 60 degrees

Methods involving mirrors and reflection score zero

(c) points plotted correctly

allow tolerance of ± half a small square

1

curve drawn passing through points

allow a line starting at the origin

1

(d) the line curves

allow the line is not straight

*allow line does not pass through the origin if consistent with their answer to question **(c)***

1

(e) normal drawn

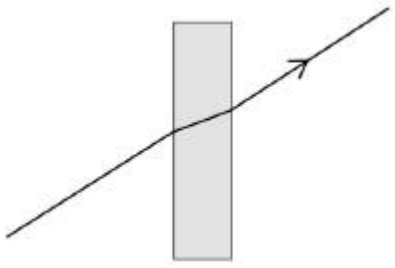
1

ray reflected so i = r

judge by eye

1

(f)



1

[13]

Q4.

(a) wavelength = Q

1

(b) $\text{amplitude} = \frac{R}{2}$

1

(c) radio waves

1

(d) s = 300 000 000 × 0.000009

1

s = 2700 (m)

1

(e) satellite communications
or
cooking /heating food
allow WiFi

1

[6]

Q5.

(a) absorbed

1

(b) wave speed = frequency × wavelength
allow correct re-arrangement

or

$v = f\lambda$

1

(c) $3.0 \times 10^8 = 4.0 \times 10^{14} \times \lambda$

1

$\lambda = \frac{3.0 \times 10^8}{4.0 \times 10^{14}}$

1

$\lambda = 7.5 \times 10^{-7}$ (m)
allow 0.000 000 75 (m)

1

[5]

Q6.

(a) ultraviolet travels at the same speed as visible light

1

(b) D

1

C

1

this order only

(c) A 400 – 315 = 85 (nm)
B 315 – 280 = 35 (nm)
C 280 – 100 = 180 (nm)

three calculations correct 2 marks

one or two calculations correct 1 mark

2

ultraviolet C (UVC)

mark dependent on all three calculations being made

1

(d) **Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content:

- ozone absorbs all of the UVC
- UVC is the most dangerous
- ozone absorbs nearly all (95%) of the UVB
- UVB has a medium risk
- ozone doesn't absorb any UVA
- ozone does not reduce risk from UVA
- UVA is the least dangerous
- the greater the ionising power the greater the absorption by ozone
- the greater the ionising power the greater the risk

- UV damages skin cells
- can lead to skin cancer
- can cause sunburn
- UV can damage eyes
- leads to problems with eyesight

(e) our eyes detect visible light

allow it would be dark all the time

allow specific effect ie plants couldn't grow

1

(f) transmitted

1

absorbed

1

this order only

[13]