

# Excellence/Exceptional Pathway

## End of Topic Assessment

# Light

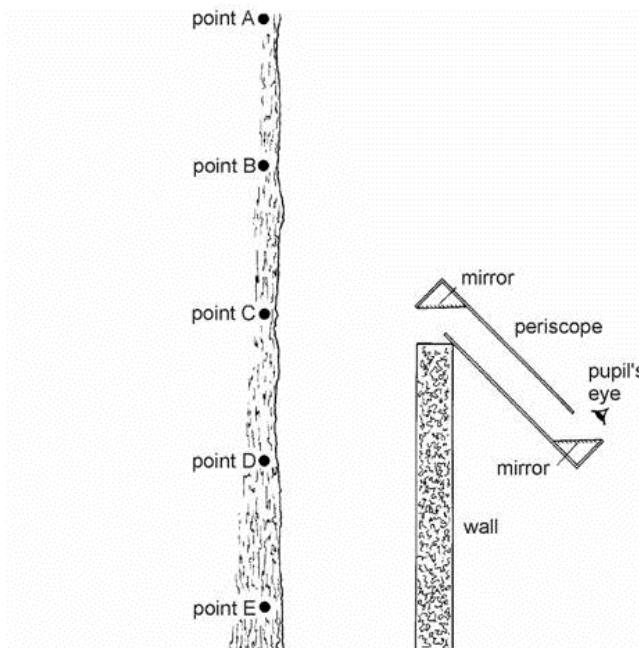
### Analysis and Targets

No.	Score	Below/On/Above	Target for next Assessment. How will you achieve it?
1	___/5		
2	___/4		
3	___/5		
4	___/5		
5	___/4		
6	___/7		

Now complete the "Next Step" sheet you've been given and when finished attach it to the back of the paper.

1.

A pupil is observing the behaviour of a woodpecker. He uses a periscope to look over a wall at a tree, and waits for the bird to land on the trunk.



The pupil can only watch one part of the tree trunk at a time.

- (a) Tick the box to show the point on the tree trunk which he can see using the periscope in the position shown.

point A	<input type="checkbox"/>
point B	<input type="checkbox"/>
point C	<input type="checkbox"/>
point D	<input type="checkbox"/>
point E	<input type="checkbox"/>

1 mark

- (b) Draw the path of the ray of light to show how the pupil sees this point. Use a ruler. Show the direction of the ray of light.

3 marks

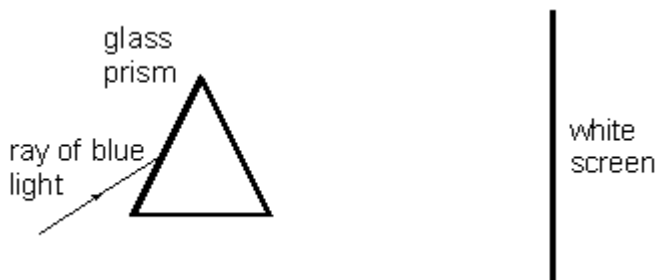
- (c) What should the pupil do to the periscope to watch point C?

.....

.....

1 mark  
Maximum 5 marks

**Q2.** A ray of **blue** light falls on a glass prism as shown in the diagram.



- (a) On the diagram, draw the path of the **blue** ray through the prism and from the prism to the screen. Use a ruler.

1 marks

- (b) The blue ray is replaced by a ray of **white** light.

- (i) What would you now see on the screen?

.....

1 mark

A red filter is placed between the prism and the screen.

- (ii) What would you now see on the screen?

.....

.....

1 mark

- (iii) Explain how the red filter causes the change.

.....

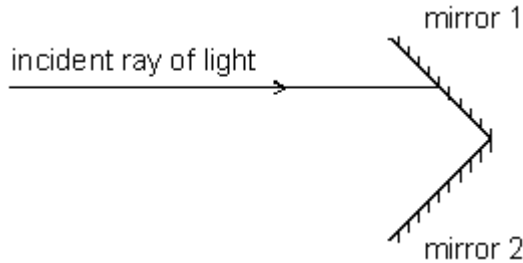
.....

1 mark  
Maximum 4 marks

**Q3.** Two mirrors at  $90^\circ$  to each other **always** reflect a ray of light back parallel to the incident ray.

- (a) (i) In the diagram below, a ray of light strikes mirror 1 at an angle of  $45^\circ$ .

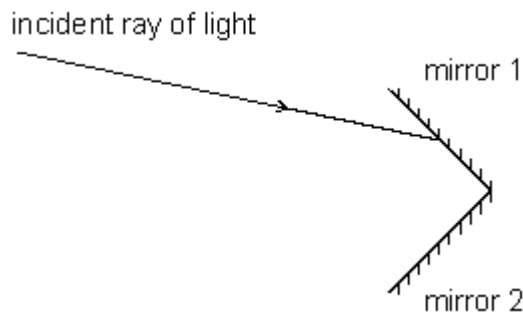
Complete the diagram to show how the mirrors reflect the ray.  
Use a ruler and a protractor.



1 mark

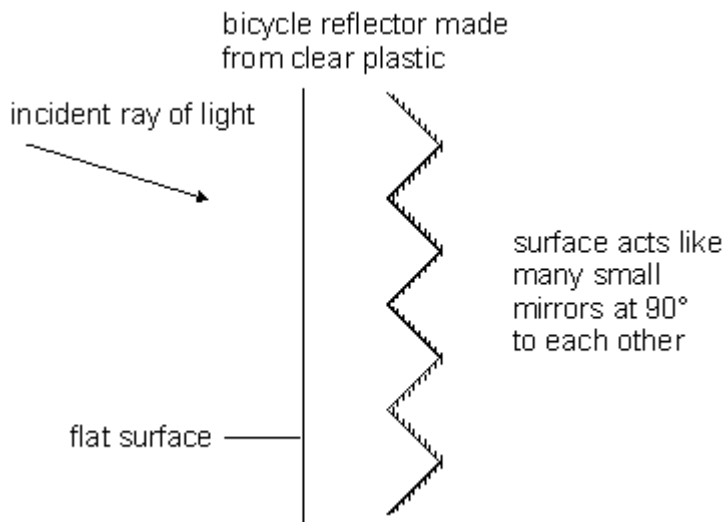
- (ii) In the next diagram, a ray of light strikes mirror 1 at a different angle.

Complete the diagram to show how the mirrors reflect the ray.  
Use a ruler and a protractor.



1 mark

- (b) Bicycles must have a reflector fixed to the rear mudguard or to the seat.



The diagram shows part of a bicycle reflector and an incident ray of light. The light passes through the flat surface and is reflected from the small 'mirrors'.

- (i) In which direction is the ray of light reflected?

.....

1 mark

- (ii) At night, car drivers can easily see bicycle reflectors in the beam from their headlights.  
Explain why.

.....

.....

1 mark

- (iii) Why is a plane mirror **not** suitable as a bicycle reflector?

.....

.....

1 mark

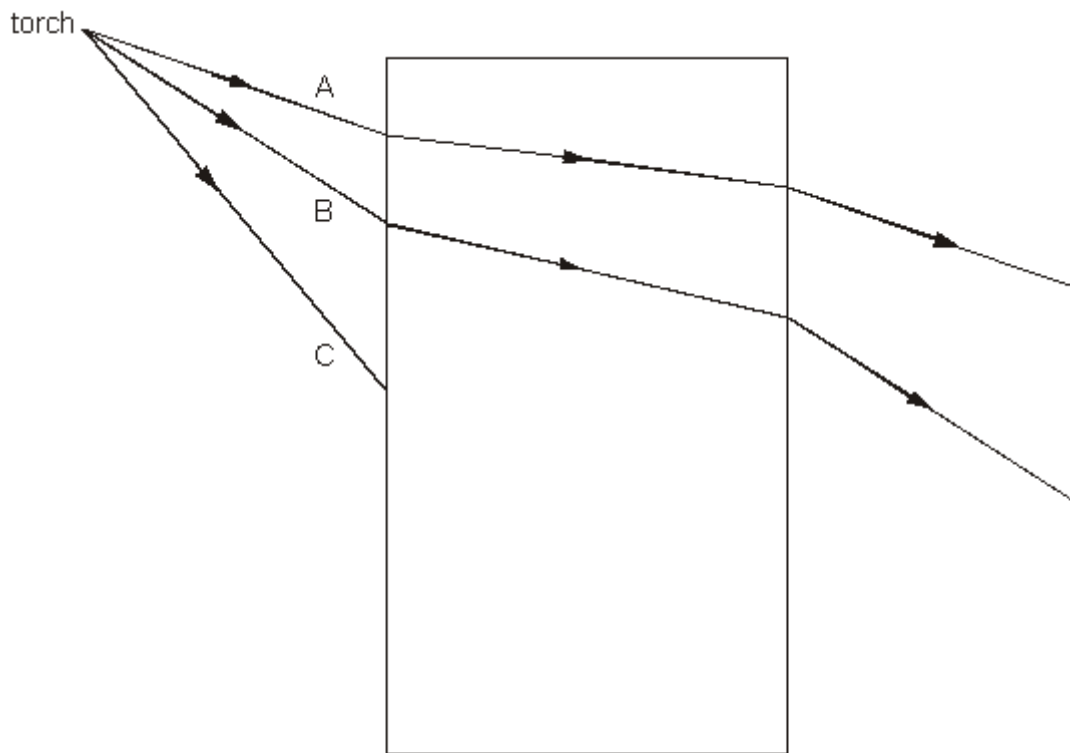
Maximum 5 marks

**Q4.** (a) When light travels from air to glass, it changes direction.  
What is the name of this effect?

.....

1 mark

(b) The diagram below shows three rays of light A, B and C striking a glass block.



The paths of A and B have been drawn.

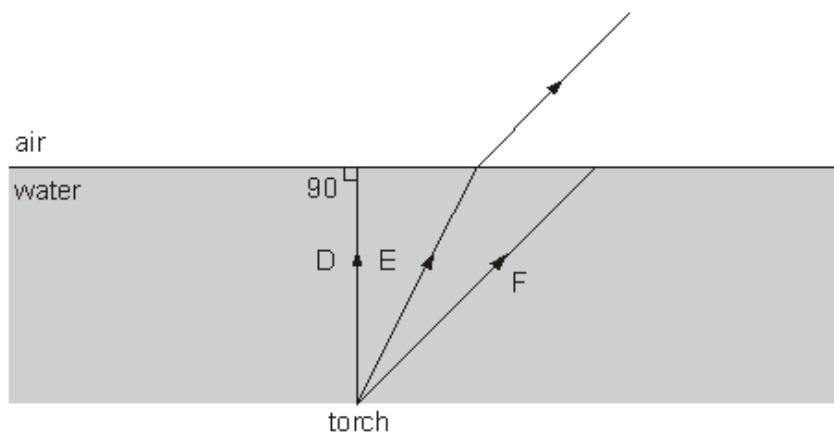
Continue ray C to show its path through the block and out the other side.  
Use a ruler.

2 marks

(c) The diagram below shows three rays of light, D, E and F, from a torch placed under water.

The path of ray E is shown as it leaves the water and enters the air.

Continue the paths of D and F as they pass through the air.  
Use a ruler.



2 marks  
maximum 5 marks

**Q5.** A white box of photographic paper has written on it, in large red letters:

**WARNING:  
OPEN ONLY BY THE LIGHT OF A RED SAFELIGHT**

(a) The box of paper is in a photographic darkroom where the only light is from a **red** lamp.

(i) What colour does the white box appear?

.....

1 mark

(ii) What colour does the red writing appear?

.....

1 mark

(b) The red lamp is now switched off and a green lamp is switched on.

(i) What colour does the red writing appear in green light?

.....

1 mark

(ii) Explain why the writing appears to be this colour.

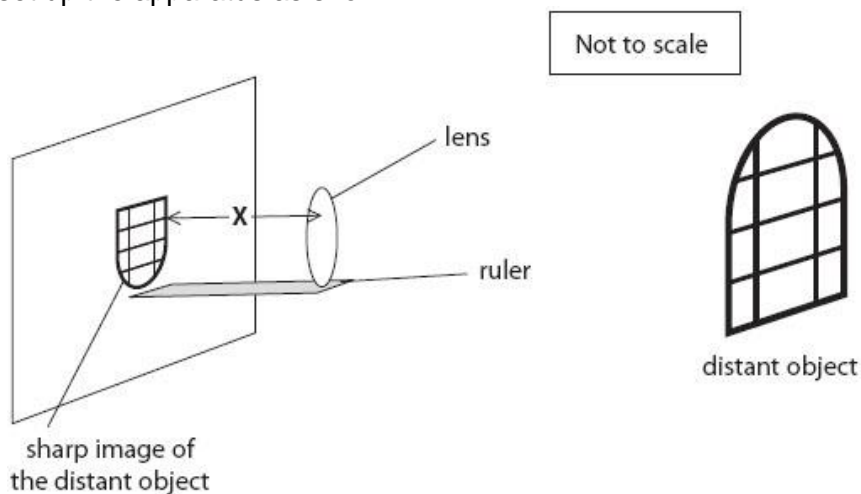
.....

.....

1 mark  
Maximum 4 marks

**Q6.**

- (a) Some students investigate a converging lens.  
The students set up the apparatus as shown.



Complete the sentence by putting a cross (☒) in the box next to your answer.

- (i) The distance **X** is

- A** the focal length
- B** the object distance
- C** the eyepiece distance
- D** the magnification

(1)

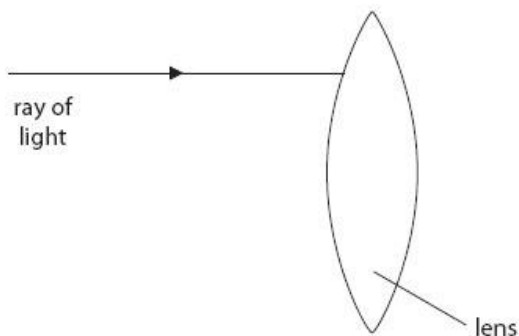
- (ii) Use words from the box to complete the sentences.

(2)

bigger than      diverging      real  
smaller than      the same as      virtual

The size of the image is ..... the distant object.  
The type of image formed on the screen is a ..... image.

- (b) The diagram shows a ray of light as it arrives at a lens.



Draw the path of the ray inside the lens.

(1)



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(c) The students use a telescope to view the Moon.  
Light from the Moon takes 1.3 s to reach the students.  
The speed of light is 300 000 km/s.  
Calculate the distance to the Moon.

(2)

distance = speed × time
-------------------------

.....

(d) Complete the sentence by putting a cross (  ) in the box next to your answer.

A satellite orbits the Moon.  
Radio waves from this satellite transfer

(1)

- A** matter only
- B** energy and matter
- C** information and matter
- D** energy and information

Maximum 7 marks

## E/E MARK SCHEME

**M1.** (a) point E

*if more than one box is ticked award no mark*

1

(b) continuous ray from point to eye

*accept a ray coming either from point E*

*or from the answer to (a)*

1

straight lines to the mirrors at appropriate angles

*reflections must be at the surfaces of the mirrors and lines must **not** extend behind the mirrors*

*the angle between the incident and the reflected rays should be approximately 90°*

*this mark may be awarded even if the reflection from the second mirror to the eye is **not** given*

1

arrow anywhere along ray pointing from tree to eye

1

(c) any **one** from

- move bottom of periscope towards wall  
*accept 'tilt it' or 'change the angle'*

- make it upright

- lift it higher

*accept 'move it up' or 'push periscope further over the wall'*

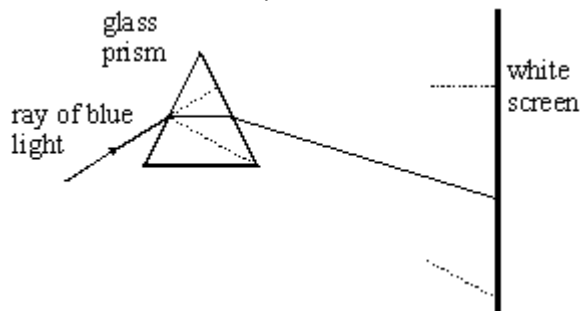
*accept 'change angle of top mirror' or 'change angle of mirrors'*

*do **not** accept 'move it'*

1

[5]

**M2.** (a) one mark is for a ray which bends to the right when it enters the prism  
the ray must be within the limits shown



1 (L6)

one mark is for a ray which bends downwards when it leaves the prism  
the ray must be within the limits shown

*award no marks if the lines are not straight*

1 (L6)

(b) (i) a spectrum

*accept 'all the colours' or 'the colours of the rainbow'  
do not accept 'a rainbow' or 'colours'*

1 (L6)

(ii) a red spot **or** a red line

*accept 'red light' or 'red' or 'all the colours  
except red would disappear'  
do not accept 'a red screen'*

1 (L6)

(iii) it absorbs **or** stops all the other colours

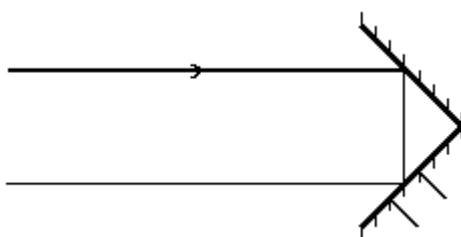
*accept 'it only lets red light pass'  
do not accept 'it lets red light pass'*

1 (L6)

[5]

**M3.** (a) answers should be straight lines which meet mirror 2 with tolerances indicated by the hatching behind the mirror

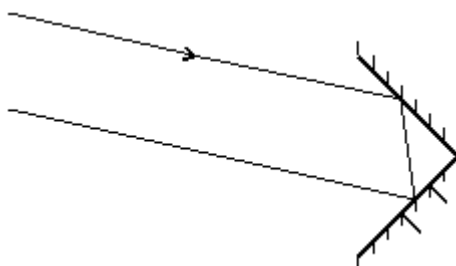
(i)



*both rays required for the mark*

*reflections at surfaces of the mirrors positioned within  
the range shown with reflected ray parallel to incident ray  
disregard any arrows*

(ii)



**both** rays required for the mark  
 reflections at surfaces of the mirrors positioned within  
 the range shown with reflected ray parallel to incident ray  
 disregard any arrows

1 (L7)

- (b) (i) parallel to the incident ray **or** back towards the source  
 accept 'back the same way'  
 accept correctly drawn rays on the diagram  
 do **not** accept 'reflected back **or** upwards **or** to the left'

1 (L7)

- (ii) light is reflected back towards car **or** driver **or** headlights

1 (L7)

- (iii) light would probably not be reflected back towards car **or** driver  
 accept 'light is reflected in a different direction **or** away'  
 do **not** accept 'it would dazzle the driver'

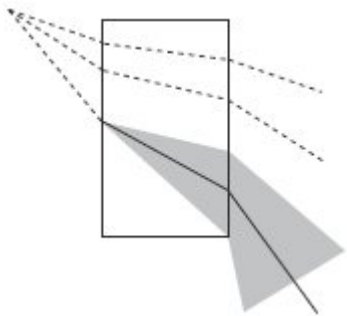
1 (L7)

[5]

- M4.** (a) refraction **or** refracting

1 (L6)

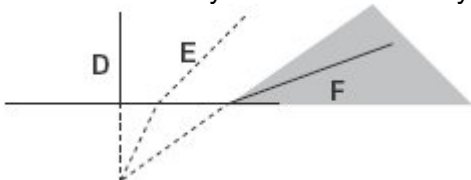
- (b) • a ray bending towards the normal at the first surface  
 accept a ray that is within the shaded area  
**both** sections of the ray must be straight and continuous  
 ignore any arrows
- an emerging ray bending away from the normal at the second surface



accept an emerging ray that is within the shaded area  
the emergent ray does not have to be parallel to the incident ray

2 (L7)

- (c)
- a continuous straight line for ray D  
*ignore any arrows*  
*ignore any reflected rays*
  - a continuous ray F that bends away from the normal



accept a ray drawn within the shaded area  
do **not** accept an emergent ray that does not refract

2 (L7)

[5]

- M5.** (a) (i) red  
*do not accept 'pink' or 'pinky red'*

1 (L7)

- (ii) red  
*accept 'dark red'*

1 (L7)

- (b) (i) black  
*do not accept 'green' or 'brown'*  
*or 'brownly black' or 'dark colour'*

1 (L7)

- (ii) any **one** from
- red ink absorbs green light
  - red ink only reflects red light
  - no green light is reflected from the ink  
*accept 'no light is reflected'*  
*accept 'there is no red light in green'*  
*do not accept 'there is no red in green'*

M6.

	Answer	Acceptable answers	Mark
(a)(i)	A the focal length (1)		(1)
(a)(ii)	smaller than (1) real (1)		(2)
(b)	<ul style="list-style-type: none"> <li>Any (more or less) straight ray which changes direction inside the lens (1)</li> </ul>	Ray does not need to touch far side. Allow slight discontinuities Ignore any ray drawn beyond the 2 <sup>nd</sup> surface and any reflected ray(s). Ignore any extra incident rays.	(1)
(c)	substitution into given equation (1) $1.3 \times 300\,000$ evaluation (1) $390\,000$ (km)	Power of 10 error max 1 mark $3.9 \times 10^5$ (km) 2 marks for correct numerical answer with no working shown Ignore any unit given by candidate.	(2)
(d)	D energy and information (1)		(1)

Total for Question = 7 marks