(2)

(c)   Give **two** similarities between an eye and a camera.

1 ....

....

2 ....

....

(2)
(Total 7 marks)

(a)   (i)   rays continued to meet on the right hand side of the lens and beyond

must be straight lines from the right hand side of the lens
ignore details through the lens
allow if no arrows

1

meet exactly on the axis

negate mark if contradictory arrow(s) added
do not need to go beyond the focus for this mark

1

(ii)   (principal) focus

or *focal (point)*

1

(iii)   converging

or *convex*

1

(b)   (i)   **A**

1

(ii)   rays seem to come from this point

or *words to this effect*
or *shows this on the diagram*

1

(iii)   diverging

or *concave*

1

(c)   film

        accept any unambiguous method of showing the correct response

        1

    smaller than

        1

    further away from

        1

(d)   any **three** from:

- real image can be put on a screen
  - *allow film*

- virtual image cannot be put on a screen / film

- virtual image is imaginary

- real image is formed where (real) rays cross / converge
  - *allow real image has light travelling through it*

- virtual image is where virtual / imaginary rays (seem to) come from
  - **or** *virtual image is where rays seem to come from*

- virtual image formed where virtual rays intersect / cross

        3

        [13]

M2.   (a)   (i)   point where the rays cross

        do not credit if ambiguous

        1

    (ii)   converging (lens)

        *do **not** accept convex*

        1

(b)   (i)   point where the rays appear to diverge from

        this should appear to be within 10mm in front of the back of the arrows on the approximate centre line

        need not be accurately constructed using a ruler

        1

    (ii)   diverging (lens)

        *do **not** accept concave*

        1

(c)   converging

        1

    film

        1

    smaller than

    nearer to

        accept any clear indication of the response e.g. ticking, ringing, writing in after a mistake

        1

(d) (i) (image) bigger than object enlarge

        accept just 'made bigger'

        1

    (ii) it / real image can be put on a screen **or** real image on the opposite side of the lens to the object

        accept 'not an imaginary or virtual image'

        assume 'it' refers to a real image

        *do **not** credit 'it can be seen'*

        1

(e) **either** (the converging lens is) thick in the middle thin(ner) at the edge

        1

        *thick<u>est</u> in the middle gains **2** marks*

        1

    or (both) sides bend outwards (1) in the middle (1)

        *convex gains **2** marks*

        *suitable diagrams gains **2** marks*

    or one side bends in the middle (1) more than the other side bends inwards (in the middle) (1)

        1

        [12]

M3. (a) 1.59

        accept an answer that rounds to this

        *allow **1** mark for correct substitution into correct equation*

        ie refractive index = $\dfrac{sine\ 16°}{sine\ 10°}$

        2

(b) 2 lines correctly drawn from the top of the pin through the lens

        *allow **1** mark for each*

        2

    position of image correct

        image must be upright

        1

        [5]

M4. makes things look bigger/clearer/nearer M used for small objects;
or to see things better T used for distant objects

magnifies **or** makes it bigger

'it' = image of object; bigger for M;
inverted/upsidedown/ other way up smaller for T

        any seven for 1 mark each

        [7]

M5. (a) straight line from the tip of the object

    … straight through the centre of the lens (1)

    … parallel to the axis, then diverges from the lens as if from F (1)

image drawn from where **these** lines intersect, vertically to the axis (1)

example
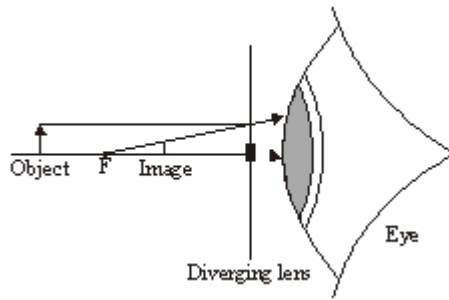
3

(b)　any **two** from:

- smaller (than the object)

- (both) upright

- image is virtual / imaginary (whereas object is real)
  no errors carried forward from the candidate's diagram
  *mark first **two** points given*

2

[5]

M6.　　**Eye –** Diminished/smaller than object
Nearer the lens than object or on the retina
for 1 mark each

2

　Projector – real
Further from lens than object
for 1 mark each

2

　Camera – real
Smaller (than object)
for 1 mark each

2

[6]

M7.　　(a)　(i)　converging / convex / biconvex
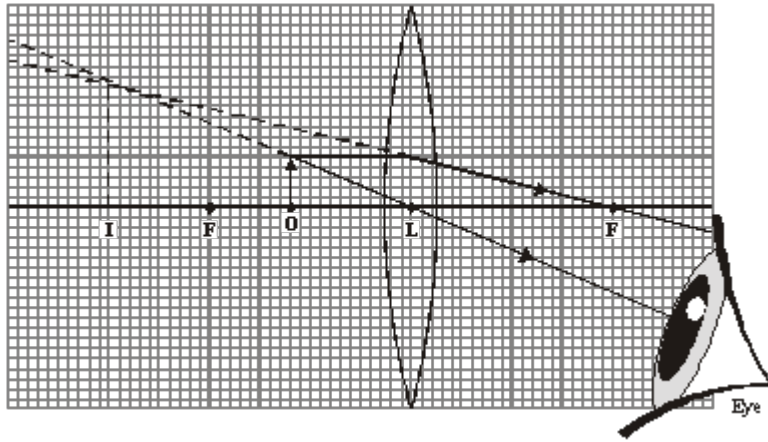
1

　　　(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)

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or … more than twice the focal length (away from the lens)
(2 marks)

1

[12]

M8. (a) (i) Image distance increases
Image size increases
Remains inverted
Remains real
for 1 mark each

2

(ii) Image distance decreases
Image size decreases
Becomes upright
Becomes virtual
for 1 mark each

2

(b) Move lens with respect to film
Closer for distant objects
Further for near objects
for 1 mark each

3

[7]