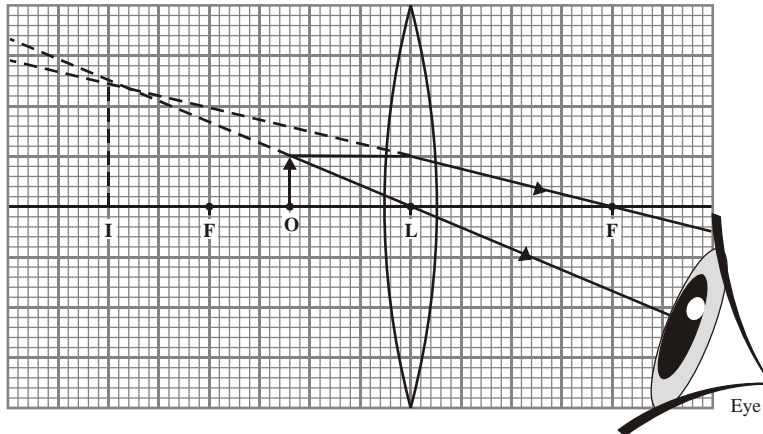


Medical applications of physics

1. (a) converging
or convex 1
- (b) (principal) focus
or focal point 1
- (c) **either** (×)1.5 **or** (×)1½ **or** 150% 2
*unambiguous evidence of appropriate measurements for 1 mark only
eg 4 and 6 or 8 and 12 or 0.8 and 1.2*
- (d) real rays cross to form it / formed at the intersection of real rays 1
*accept 'image on the opposite side of the lens to the object'
accept 'can be put onto a screen'*
- [5]
2. (a) (i) **A, C and D** any order but all three required and no others 1
(ii) **D and E** either order but both required and no others 1
- (b) (i) 20000 (Hz) to 20 (Hz)
accept '19980 (Hz)'
or vice-versa 1
- (ii) frequency (of dog whistle) too high (for humans to hear) /
frequency above 20000 Hz 1
*accept 'it is ultrasound'
accept 'sound from the whistle is ultrasonic'*
- (c) (i) substance 1
reflection 1
correct order essential
- (ii) detector 1
- [7]
3. (a) any **two** points:
*do not credit features which are true of sound in general
eg longitudinal waves*
- humans cannot hear ultrasound
 - it has a very high frequency / pitch
do not credit just 'has a high frequency / pitch'
 - above the (upper) limit for humans / above 20 000 Hz 2
- (b) (i) ultrasound / waves are reflected 1
...are bounced is insufficient, but echo is acceptable
- Pulse **A** indicates / is the crack
- Pulse **B** indicates / is the back (of the block or crack) 1
need to mention both A and B to get this mark
- (ii) 90 (mm) 1
accept any answer in the range 88 – 92 (mm)
- [5]

4. (a) (i) converging / convex / biconvex 1
 (ii) focal (points) **or** foci 1
 *accept focuses **or** focus (point)*
 (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

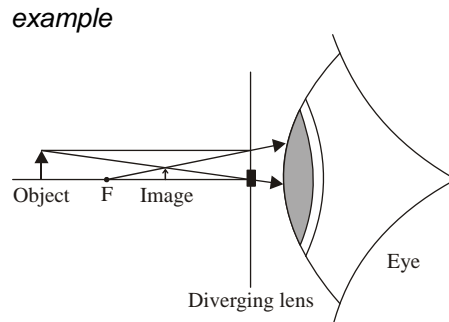
- ray that continues from the top of the object through L to the eye 1
 - horizontal ray from the top of the object, refracted by the lens and continued through F on the r.h.s. to the eye 1
 - back projections of these rays (shown as dotted lines) 1
 - image 25 mm high at 61 mm left of L (tolerance 1 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 1
accept (virtual image) is imaginary
accept cannot be put on screen
*do **not** credit just '... is not real'*
- (b) (the image) needs to fall on film / sensors / LDRs / CCDs 1
accept just 'charged couples'
*do **not** credit '... solar cells'*
*do **not** accept virtual image cannot be stored*
- either** 1
 to cause a (chemical) reaction **or** to be digitalised
for credit response must be appropriate to camera type
- object (should be) on the far side of F / the focus (from the lens) 1
***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)

[12]

5. (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)

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]

6. *idea that*
X-rays cause mutations

gains 1 mark

but X-rays can cause/increase chance of mutations
gains 2 marks

mutations usually harmful/produce abnormal growth
serious effect on growing foetus/rapidly growing cells
each for 1 mark

[4]