SPECIMEN MATERIAL

A-level
PHYSICS
(7408/3BB)

Paper 3 – Section B (Medical Physics)

Specimen 2014 Morning Time allowed: 2 hours

Materials
For this paper you must have:
- a pencil
- a ruler
- a calculator
- a data and formulae booklet
- a question paper / answer book for Section A.

Instructions
- Answer **all** questions.
- Show all your working.
- The total time for both sections of this paper is 2 hours.

Information
- The maximum mark for this section is 35.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname

Forename(s)

Candidate signature _____

Section B

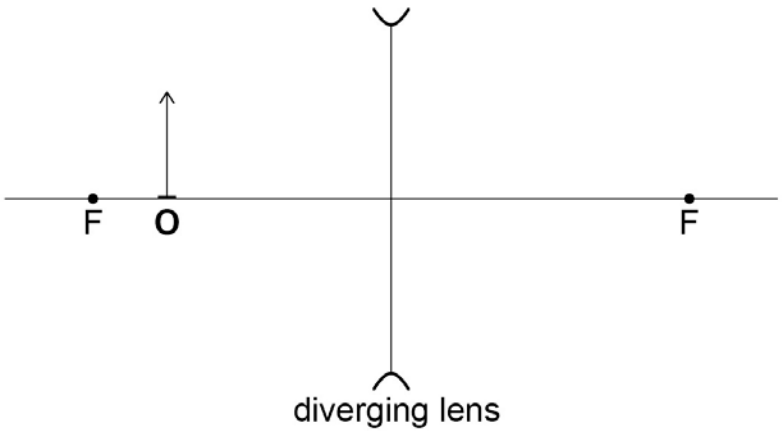
Answer **all** questions in this section.

0 1 . 1 State what is meant by the principal focus and the power of a converging lens.

[2 marks]

0 1 . 2 Complete the ray diagram below to show the formation of an image of a real object O by a diverging lens. Label the image clearly.

[2 marks]



0 1 . 3 State the defect of vision that would be corrected using a diverging lens.

[1 mark]

0 1 . 4 A diverging lens of focal length −0.33 m is used to view a real object placed 0.25 m from the lens.

Calculate the distance from the lens to the image.

[2 marks]

distance from lens to image = _____ m

0 1 . 5 Two point sources of light are viewed by a normal eye and their images are formed at the fovea.

State, in terms of the active receptors, the conditions necessary for two separate images to be seen.

[2 marks]

_____

_____

_____

_____

0 2 . 1 Sound waves are incident on a human ear.

Describe how the frequency and amplitude of the vibrations change as the wave is transmitted through the ear to the fluid in the inner ear.

[2 marks]

0 2 . 2 Explain how the components of the ear act to amplify the pressure changes due to the sound wave.

[3 marks]

0 2 . 3 A sound intensity meter, set to the dB scale, is placed near to a source of sound. The intensity level reading on the sound meter is 82 dB.

Calculate in, $\mathrm{W\ m^{-2}}$, the intensity of the sound at the meter.

[3 marks]

intensity = _____ $\mathrm{W\ m^{-2}}$

0 2 . 4 The sound intensity meter is 2.0 m from the source which is emitting sound equally in all directions.

Calculate the power emitted by the source.

[2 marks]

power = _____ W

Turn over for the next question

0 3 Positron Emission Tomography (PET) and ultrasound scans are both used in medical diagnosis. Compare the quality of the information obtained from these scans in terms of:

- patient safety and convenience
- information available to the doctor from the images.

[6 marks]

0 4 . 1 Explain why the effective half-life of a radionuclide in a biological system is always less than the physical half-life.

[2 marks]

0 4 . 2 The physical half-life of a radionuclide is 20 days. The nuclide was administered to a patient. Initially the corrected count rate at the patient's body was 2700 counts s^{-1}. Five days later, the corrected count rate at the same place on the patient was 1200 counts s^{-1}.

Calculate the biological half-life of the nuclide.

[4 marks]

biological half-life = _____ days

0 4 . 3 **Table 1** gives the properties of two radionuclides.

Table 1

	Technetium 99 m	**Iodine 131**
emitted radiation	gamma	beta$^-$ and gamma
half-life / hours	6.0	190
energy of gamma ray / keV	140	610

By considering information in **Table 1** suggest which of these nuclides is more suitable for use as a tracer in medical diagnosis.

[4 marks]

END OF QUESTIONS

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