

# 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]**

---

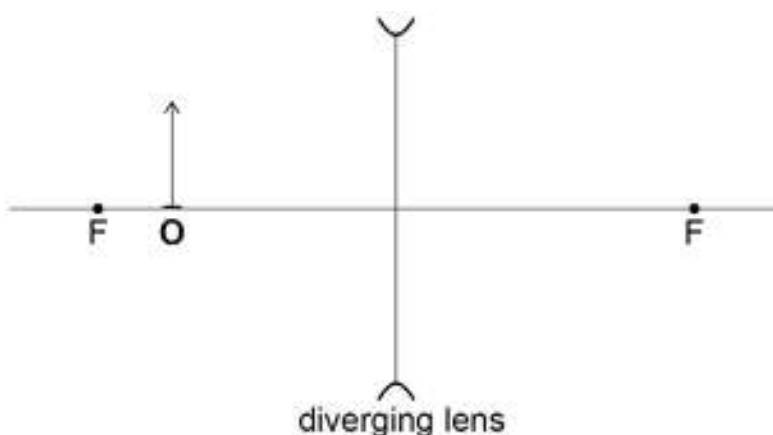


---



---

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

**[3 marks]**

intensity = \_\_\_\_\_  $\text{W m}^{-2}$

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**

[illegible]

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  $2700 \text{ counts s}^{-1}$ . Five days later, the corrected count rate at the same place on the patient was  $1200 \text{ counts s}^{-1}$ .

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**

	<b>Technetium 99 m</b>	<b>Iodine 131</b>
emitted radiation	gamma	beta <sup>-</sup> 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**