

A level Physics B

H557/01 Fundamentals of physics

Question Set 32

1 (a) This question considers the digital image processing of medical images.

Fig. 1.1 compares the response to radiation of photographic film **F** and a digital X-ray detector **D**.

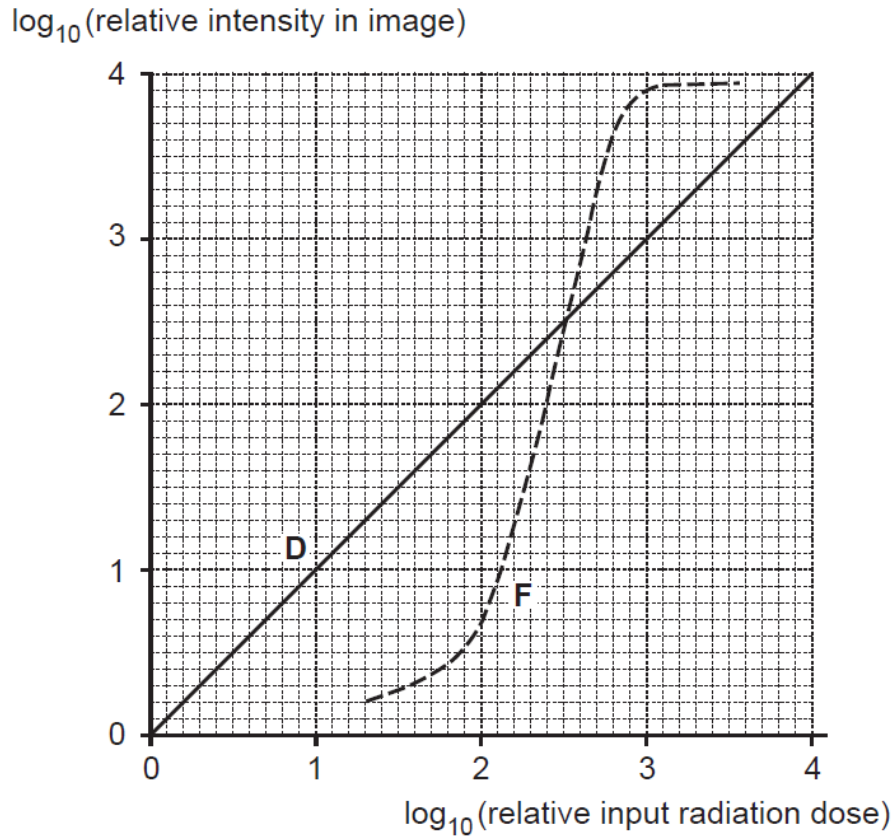


Fig. 1.1

- (i) State why a log – log scale has been used to represent the data. [1]
- (ii) State an advantage that the response of the detector **D** has over that of the film **F**. [1]
- (iii) For detector **D** the relative intensity is the pixel value.

Show that 14 bits per pixel are enough to cover the range of intensities plotted.

[2]

- (b) **Fig. 1.2** and **Fig. 1.3** show an X-ray digital detector image before and after image processing.

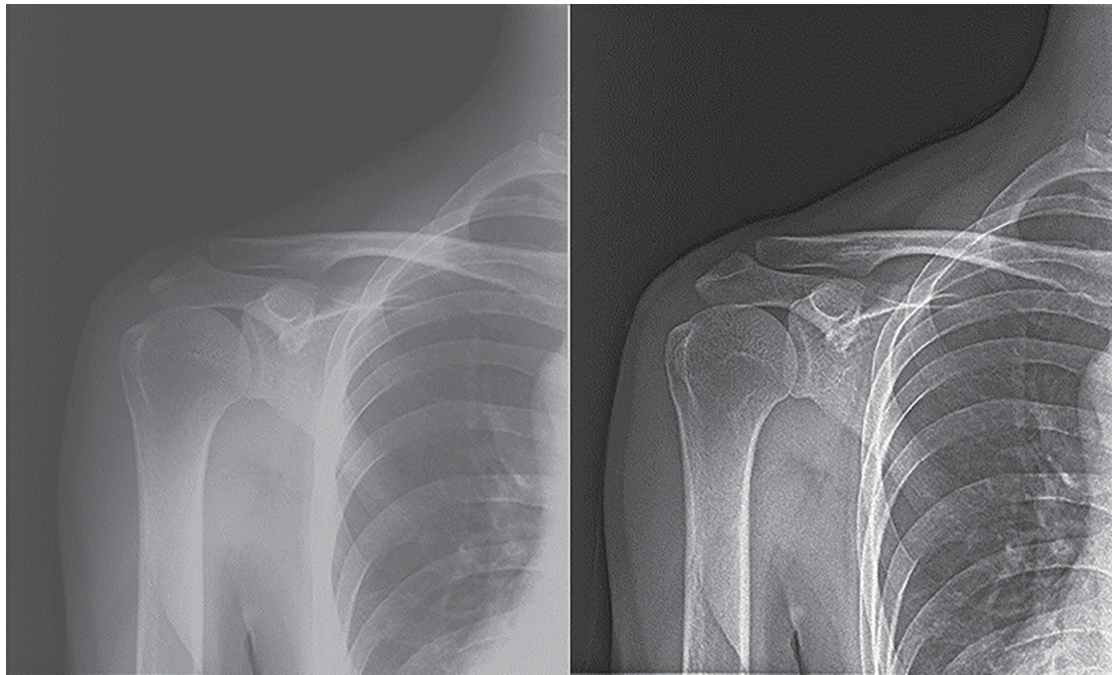


Fig. 1.2

Fig. 1.3

The image format is 2048×1680 pixels with 4096 greyscale levels.

- (i) Calculate the amount of memory in bits needed to store an uncompressed image.

memory required =bits **[2]**

- (ii) During image processing the radiologist interpreting the image can stretch the contrast of the bone structures (whiter parts of image) more than the darker regions.

Suggest a benefit to the radiologist of having different contrast adjustment applied to different pixel value ranges.

[1]

- (iii) Identify **one** process (other than contrast improvement) that has been applied to the image in **Fig. 1.2** to produce the enhanced image in **Fig. 1.3**. Suggest the benefit to the radiologist interpreting the image.

[1]

Total Marks for Question Set: 8

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