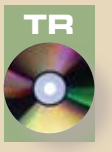
MEDICAL PHYSICS: REVIEW QUESTIONS



Verb scaffolds
Working with the verbs
Sample answers and marking criteria

Working with the HSC verbs

1. Define 'acoustic impedance'.
2. Identify one advantage of the using ultrasound as a diagnostic tool.
3. When performing an ultrasound scan, gel must be applied between the ultrasound probe and the skin. Account for this.
4. Outline the function of the radio frequency oscillator and the radio receiver in MRI.
5. Outline the reasons for hydrogen nuclei being the target nuclei in MR image formation.
6. Discuss the need for radiopharmaceuticals in nuclear medicine.
7. Explain the significance of total internal reflection for the operation of endoscopies.
8. Justify the role of piezoelectric crystals being both the source and receiver of ultrasound waves.
9. Gamma ray emitting radioisotopes that have a short half-life are most suitable for conducting radioisotope scans. Justify this statement.
10. Describe the utilisation of the Doppler effect in studying the blood flow through the heart.
11. Describe two similarities and two differences between a standard radioisotope scan and a PET scan.
12. With the aid of a diagram, describe the production of X-rays for both plain X-ray films and computer tomography.
13. Assess the impact of the invention of endoscopes on the diagnosis and the treatment of diseases.
14. Computer tomography has revolutionised the level of sophistication of medical imaging methods. Evaluate the significance of computer tomography in improving the accuracy of medical imaging methods.
15. Assess the impact of the development of CT, PET and MRI on our understanding and ability to diagnose brain diseases.
16. Assess the impact of advances in the understanding of electromagnetic radiation on the development of medical imaging methods.
17. Evaluate the impact of advances in medical physics on the society and environment.
18. MRI relies on the aligned hydrogen nuclei re-emitting the absorbed radio wave energy, a process known as relaxation, for its image reconstruction. Analyse how different types of relaxation and relaxation times of the hydrogen nuclei found in different tissue types contribute to the tissue contrast in MRI.
19. Johnny fell and landed on his right hand. He presented to his GP and complained about pain in his right wrist. The GP suspected that he might have suffered a fracture of one of his wrist bones.
    (a) Justify the need for a plain X-ray film of his right wrist.
    (b) The X-ray film failed to reveal any fractures. The GP then ordered a bone scan of the wrist. Compare and contrast the information that may be provided by the bone scan to those provided by the X-ray film.
    (c) Discuss the role of a CT scan in this clinical scenario.

(d) If all investigations so far are negative and pain persists, justify the need for an MRI of the wrist.

20. Peter presented to his GP with a two-month history of abdominal pain.

(a) The GP suspected that he might have gall bladder stones and ordered an ultrasound scan of his gall bladder. Justify the need for the ultrasound scan in view of possible gall bladder stones.

(b) Would plain X-ray films have any value in this clinical setting? Explain.

(c) An ultrasound of Peter's gall bladder failed to show any gallstones. The GP went on to order a CT scan of his abdomen. Evaluate the use of CT for diagnosing the cause of abdominal pain.

(d) The CT scan failed to show any significant pathologies and Peter's abdominal pain persisted. GP referred Peter to a gastroenterologist who then went on to perform an endoscopy to look for ulcers of the interior stomach wall. Discuss the role of endoscopy in diagnosing and treatment of stomach ulcers.