

Name of the Student: _____

Max. Marks : 21 Marks

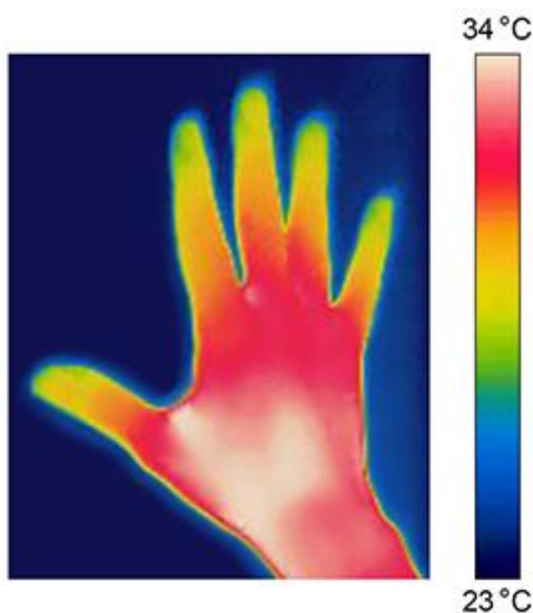
Time : 21 Minutes

Q1.

Different parts of the electromagnetic spectrum are used in medical imaging.

Figure 1 shows an Figure of a person's hand taken with an infrared camera.

Figure 1



- (a) Explain why the infrared camera is able to show that parts of the hand are at different temperatures.

(2)

- (b) Infrared has a range of wavelengths from 700 nm to 1 mm.

Which part of the electromagnetic spectrum would have waves with a wavelength of 6.5×10^{-7} m?

Tick (✓) **one** box.

Infrared

Microwaves

Radio waves

Visible light

(1)

(c) **Figure 2** shows X-rays and gamma rays being used for medical imaging.

Figure 2



To use X-rays for medical imaging, a machine produces a very brief burst of X-rays.

To use gamma rays for medical imaging, a radioactive isotope is injected into the patient's blood. The isotope is circulated around the body in the blood. The isotope emits gamma rays.

Compare the potential risks to a patient of using X-rays and gamma rays for medical imaging.

(4)

X-rays are produced by colliding high-energy electrons into a metal target.

The electrons have high energy because they are accelerated to high speeds.

Only a small proportion of the kinetic energy of an electron is converted into an X-ray when it collides with the metal target.

(d) An electron is accelerated through a distance of 15 mm.

The work done on the electron is 1.2×10^{-13} J.

Calculate the force on the electron.

Force = _____ N

(3)

(e) The metal target is made from tungsten.

Tungsten has the highest melting point of any metal.

Explain why using tungsten as the metal target enables the X-ray machine to be more powerful.

(3)

(Total 13 marks)

Q2.

The photograph below shows a computer keyboard.

There is a spring under each key.



(a) The springs behave elastically when a force is applied.

What is meant by elastic behaviour?

Tick (✓) **one** box.

The spring will be compressed when the force is applied to it.

The spring will become deformed when the force is applied to it.

The spring will become longer when the force is removed.

The spring will return to its original length when the force is removed.

(1)

(b) Suggest **two** properties that should be the same for each spring.

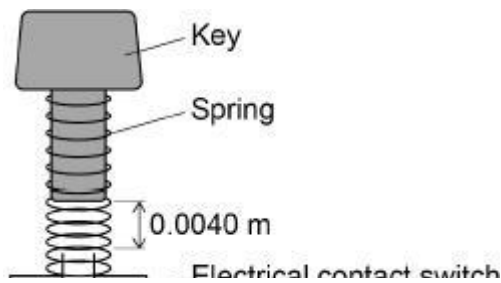
1. _____

2. _____

(2)

(c) **Figure 1** shows one of the keys and its spring.

Figure 1



The key must be pressed with a minimum force of 0.80 N before the key touches the switch.

Calculate the spring constant of the spring in **Figure 1**.

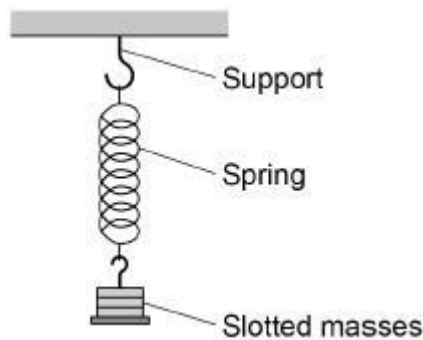
Spring constant = _____ N/m

(3)

(d) **Figure 2** shows a spring that has been hung from a support.

The spring is stationary and has been stretched beyond its limit of proportionality.

Figure 2



Which **two** statements are true for the spring in **Figure 2**?

Tick (✓) **two** boxes.

The elastic potential energy of the spring is zero.

The extension of the spring is directly proportional to the force applied.

The upward force on the spring is equal to the downward force.

The spring cannot be stretched any further.

The spring is inelastically deformed.

(2)
(Total 8 marks)