EM Wave – EM Circus Activities

Radio Circus Station – Answer Sheet

What to do	Diagram / Picture	Observation
Use your mobile phone (you may use it at this experimental station only) try to connect using Bluetooth to the mobile phone. Now move away from the mobile phone and estimate the maximum distance that the Bluetooth link works over.		This is usually around 12-15m. It should work around corners. Illustrating radio waves diffract around corners.
Put the supplied mobile phone inside the paper container. Does the Bluetooth link still work?		Bluetooth link works
Put the supplied mobile phone inside the card container. Does the Bluetooth link still work?		Bluetooth link works
Put the supplied mobile phone inside the plastic bag. Does the Bluetooth link still work?		Bluetooth link works

What to do	Diagram / Picture	Observation
Build a wooden enclosure entirely around the phone using the blocks. Does the Bluetooth link still work?		Bluetooth link works
Put the phone inside two plastic bags and make sure that each bag is effectively sealed. Put bagged phone in the beaker of water. Does the Bluetooth link still work?		Bluetooth link might or might not work. If it does work, this can be reasoned by the fact that the radiowaves used by Bluetooth are at wavelengths that are not absorbed by water molecules. If it doesn't work then, this can be explained by the radiowaves being absorbed by the water molecules.
Put the phone inside the metal case and close the lid. Does the Bluetooth link still work?		Bluetooth link won't work. The metal case is a faraday cage through which radiowaves cannot penetrate.

NB ensure that the plastic bags will fully seal before the phone is placed underwater.

Infra-Red Station – Answer Sheet

Safety

DO NOT DIRECT THE LED LIGHT INTO YOUR EYE. IT IS EMITTING UV LIGHT WHICH COULD CAUSE DAMAGE TO YOUR EYE.

What to do	Diagram / Picture	Observation
Point the IR LED at the white card		Nothing visible.
Now point the IR LED at the digital camera (or the camera on your phone)		A bright white signal is visible. The CCD chip in the camera can detect the IR light unlike the human eye.
Point the IR LED at the IR detector		When correctly aligned the red LED of the detector will light up.
Point the IR LED at the plane mirror. Move the IR detector around to try to detect the reflection.		IR light can be reflected.
Point the IR LED at the 45° prism. Move the IR detector around to try to detect the reflection.		IR light undergoes TIR.
Point the remote control the IR detector and press a button on the remote control.		The red LED will flash. This is the digital signal used by the remote control.

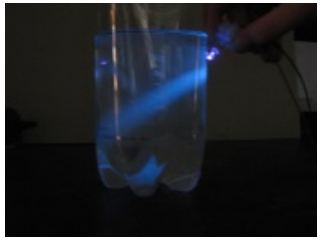
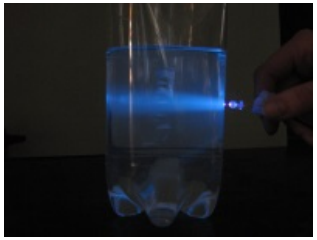
Visible Circus Station – Answer Sheet

What to do	Diagram / Picture	Observation
Look through one of the polaroid sheets.		View just slightly darker as some light removed by polariser.
Look through two polaroid sheets and then rotate one relative to the other.		When the two planes of polarisation are at right angles to each other, no light will pass through the pair of polarisers.
Display a white image on the projector screen (eg a blank PowerPoint slide) hold up one polaroid sheet in front of the screen.		The shadow of the polariser will be green.
Change the angle of the polaroid sheet.		The shadow will become purple.
View a laptop screen (displaying a white image) through a magnifying glass.		Individual Red, Green and Blue pixels are visible.

Ultraviolet Circus Station – Answer Sheet

Safety

DO NOT DIRECT THE LED LIGHT INTO YOUR EYE. IT IS EMITTING UV LIGHT WHICH COULD CAUSE DAMAGE TO YOUR EYE.

What to do	Diagram / Picture	Observation
Using a highlighter pen draw on a piece of paper. In a darkened room shine the UV light onto the lines.		The security features imbedded in the notes become visible.
Shine the UV light onto bank notes to view the security features imbedded in the notes.		
Shine the UV light into a beaker of tonic water.	 	Quinine in the tonic water fluoresces when illuminated by UV light. The beam of UV light from the LED is clearly visible.

X Ray

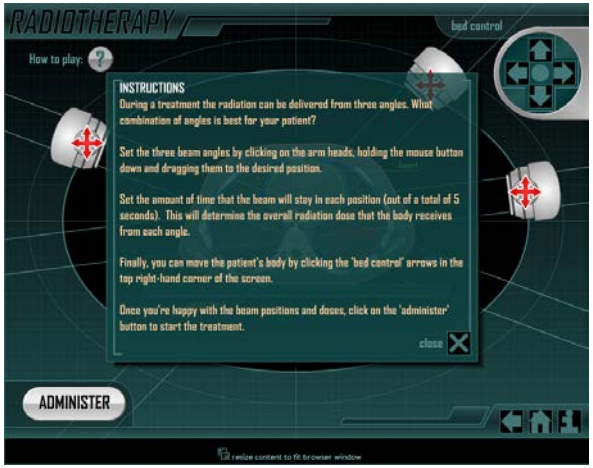
What to do	Diagram / Picture	Observation
Look at the X Rays.		

Gamma Circus Station

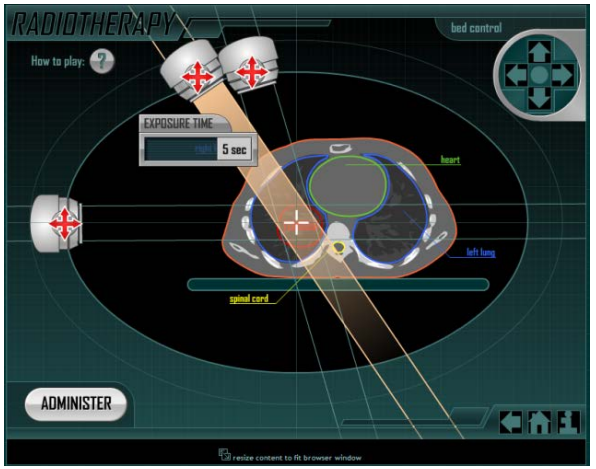
Follow instructions on flash player game.

http://www.insidestory.iop.org/insidestory_flash1.html

A screenshot of the opening of the game



A screenshot of the instructions of the game



A screenshot of the actual game

What effect does the gamma radiation have on the patient's tissue?

The gamma radiation can cause ionisation of and hence damage to the DNA of the cell. Depending upon the extent of damage, this could lead to cell death, a mutation (which gets passed on when the cell divides and hence could lead to cancers) or, if the damage is minor, then the cell may be able to repair the damage to the DNA with no ill effect.

Why is it important to keep the gamma radiation exposure time as short as possible?

To avoid damage to healthy tissue as much as possible.