

MUS HW 4 CD Players

32 min
32 marks

1. (a) Explain with the aid of diagrams why transverse waves can be polarised but longitudinal ones cannot be polarised.

.....

.....

.....

.....

.....

(3)

(b) Describe with the aid of a diagram how you could demonstrate that light can be polarised.

.....

.....

.....

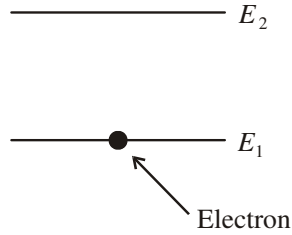
.....

.....

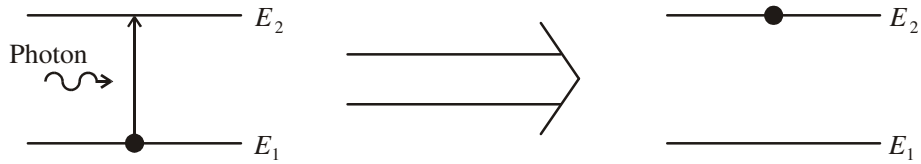
(3)
(Total 6 marks)

2. The diagrams below are taken from a description of how a laser works. Each diagram illustrates some aspect of a “two energy level system”. The system consists of an electron in an isolated atom.

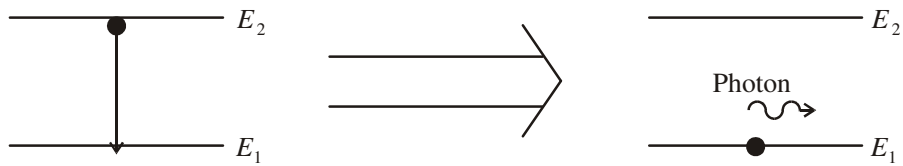
A two energy level system



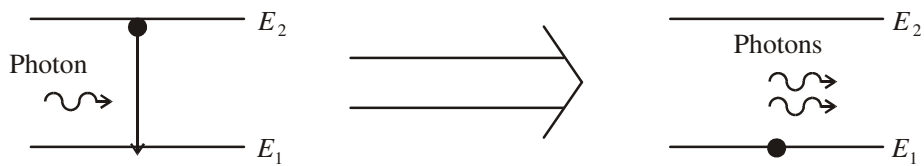
Absorption



Spontaneous emission



Stimulated emission (laser)



What is meant by energy level?

.....

.....

(1)

What is a photon?

.....
.....

(1)

Write down a formula in terms of E_1 and E_2 for the energy of the photon in the absorption diagram.

Energy =

(1)

The laser light emitted by the stimulated emission process must have the same wavelength as the photon in the spontaneous emission diagram. Explain this.

.....
.....
.....

(1)

The laser light is said to be coherent. Explain the meaning of coherent.

.....
.....
.....

(1)

(Total 5 marks)

3. Explain what is meant by the term **polarisation** when referring to light.

.....
.....
.....
.....

(2)

Sugar is produced from plants such as sugar cane. The stems are crushed and the juice extracted. The concentration of sugar in the juice is used to value the crop.

The concentration can be determined using polarised light.

Explain how to measure the angle of rotation of polarised light when it passes through a sugar solution.

.....

.....

.....

.....

.....

.....

.....

.....

.....

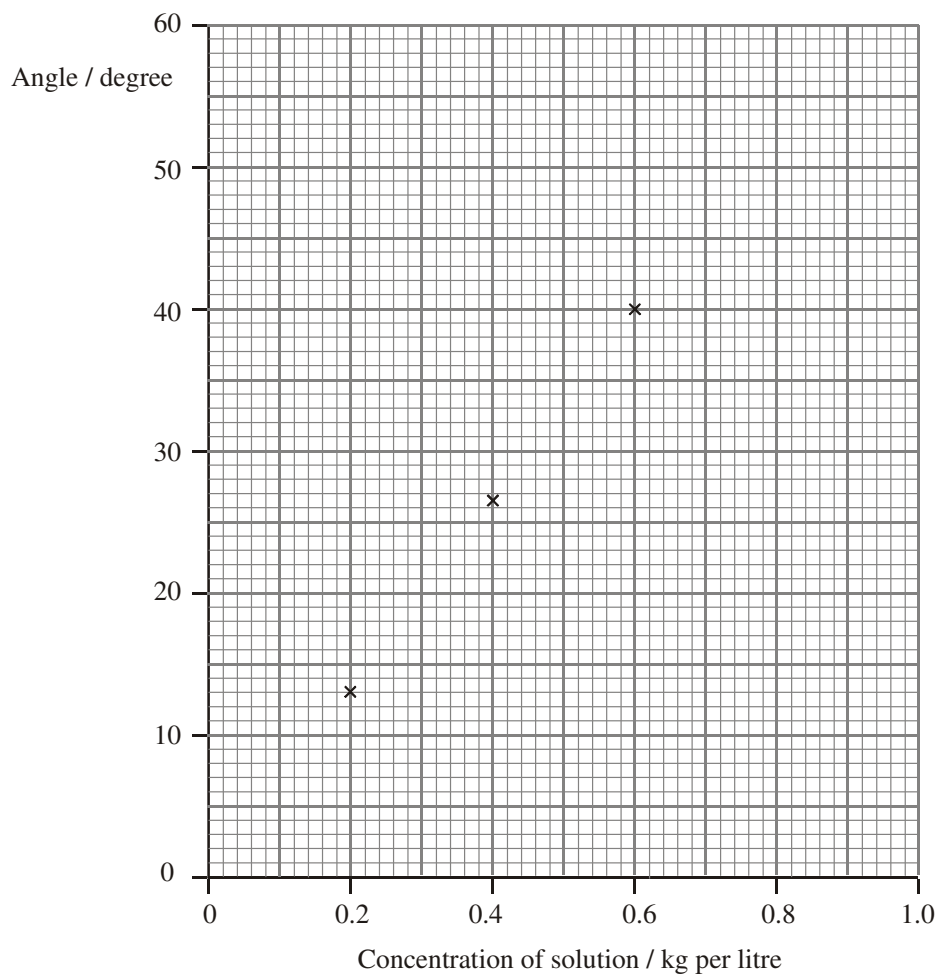
(4)

A student has carried out this experiment and obtains three results. He has plotted them on the graph below. He takes three more results and tabulates them.

Angle of rotation/degrees	Concentration of solution/ kg per litre
17	0.25
33	0.50
50	0.75

Add these results to the graph.

(3)



Use your graph to determine the concentration of an unknown sample which gives a rotation of 38° .

Concentration: kg per litre

(1)

(Total 10 marks)

4. Astronomers can identify different gases present in the outer parts of stars by analysing the line spectra of the starlight.

Explain the meaning of *line spectra*.

.....
.....
.....
.....

(2)

Explain how line spectra provide evidence for the existence of energy levels in atoms.

.....
.....
.....
.....
.....
.....

(3)

(Total 5 marks)

5. A photographer uses a polarising filter over the camera lens. She notices that the intensity of the light received from the blue sky changes as she rotates the filter.

What does this suggest about light from the sky?

.....
.....

(1)

Explain the change in intensity as the filter is rotated.

.....
.....
.....
.....

(2)

The use of a polarising filter makes a blue sky appear darker, but the clouds remain bright.
Suggest why there is little change in the intensity of the light from the clouds.

.....
.....
.....

(1)

Astronomers notice the same effect with the radio waves emitted by some galaxies.
What does this suggest about these radio waves?

.....
.....

(1)

State why radio waves should behave in the same way as light.

.....
.....

(1)

(Total 6 marks)