Advanced Higher Physics
Waves
Check Test 3: Polarisation

1. A student is observing the effect of passing light through polarising filters.

Two polarising filters, the polariser and the analyser, are placed between a lamp and the student as shown in Figure 12A.

The polariser is held in a fixed position, and the analyser can be rotated. Angle θ is the angle between the transmission axes of the two filters.

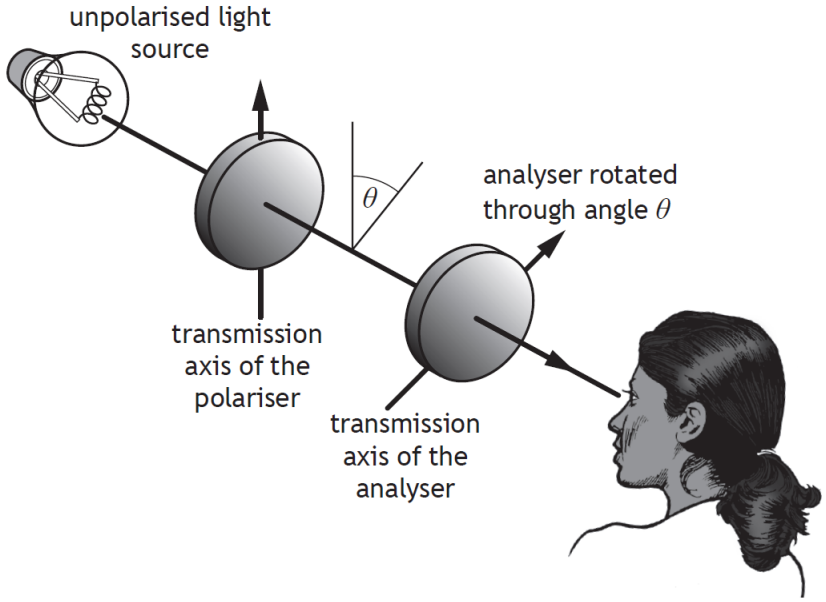

Figure 12A

When the transmission axes of the polariser and the analyser are parallel, θ is 0° and the student observes bright light from the lamp.

(a) (i) Describe, in terms of brightness, what the student observes as the analyser is slowly rotated from 0° to 180°. **2**

(ii) The polariser is now removed.

Describe, in terms of brightness, what the student observes as the analyser is again slowly rotated from 0° to 180° **1**

(b) Sunlight reflected from a wet road can cause glare, which is hazardous for drivers. This is shown in Figure 12B

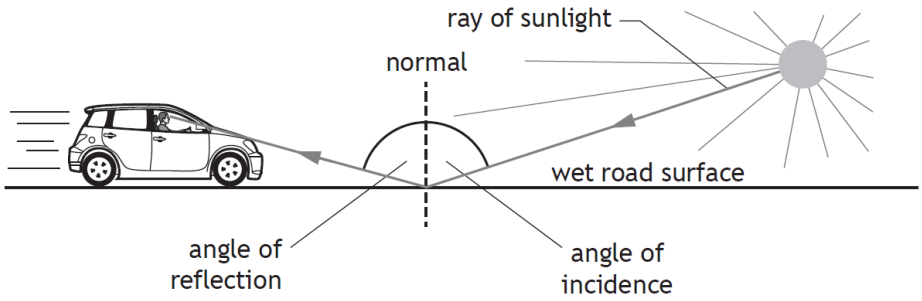

Figure 12B

Reflected sunlight is polarised when the light is incident on the wet road surface at the Brewster angle.

(i) Calculate the Brewster angle for light reflected from water. **3**

1. (b) continued

(ii) A driver is wearing polarising sunglasses.

Explain how wearing polarising sunglasses rather than non-polarising sunglasses will reduce the glare experienced by the driver. **1**

2. Some early 3D video cameras recorded two separate images at the same time to create two almost identical movies.

Cinemas showed 3D films by projecting these two images simultaneously onto the same screen using two projectors. Each projector had a polarising filter through which the light passed as shown in Figure 12.

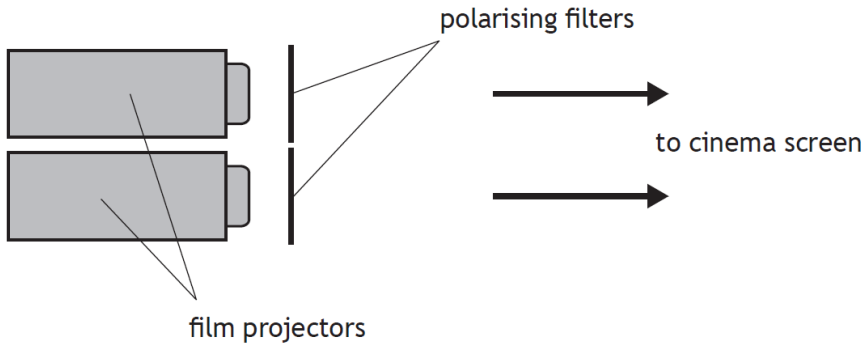

Figure 12

(a) Describe how the transmission axes of the two polarising filters should be arranged so that the two images on the screen do not interfere with each other. **1**

(b) A student watches a 3D movie using a pair of glasses which contains two polarising filters, one for each eye.

Explain how this arrangement enables a different image to be seen by each eye. **2**

(c) Before the film starts, the student looks at a ceiling lamp through one of the filters in the glasses. While looking at the lamp, the student then rotates the filter through 90°.

State what effect, if any, this rotation will have on the observed brightness of the lamp.

Justify your answer. **2**

(d) During the film, the student looks at the screen through only one of the filters in the glasses. The student then rotates the filter through 90° and does not observe any change in brightness.

Explain this observation. **1**

3. A student, wearing polarising sunglasses, is using a tablet outdoors. The orientation of the tablet seems to affect the image observed by the student.

Two orientations are shown in Figure 13A.

landscape mode portrait mode

Figure 13A

(a) In landscape mode the image appears bright and in portrait mode it appears dark.

(i) State what may be concluded about the light emitted from the tablet screen. **1**

(ii) The student slowly rotates the tablet. Describe the change in the brightness observed by the student as it is rotated through 180°. **2**

(b) Unpolarised sunlight is incident on a water surface as shown in Figure 13B.

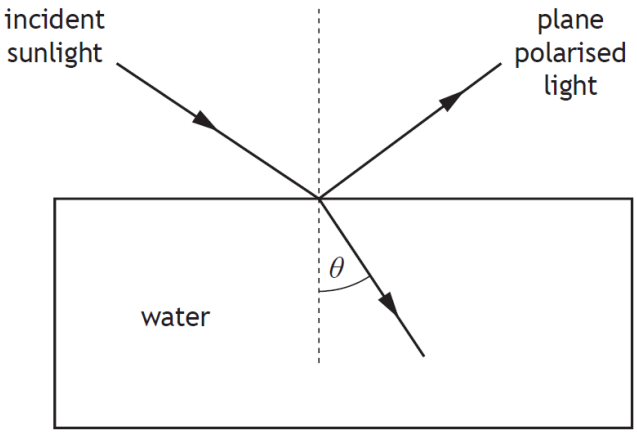

Figure 13B

The light is 100% plane polarised on reflection.

Calculate the angle of refraction θ. **4**

Total Marks: 20