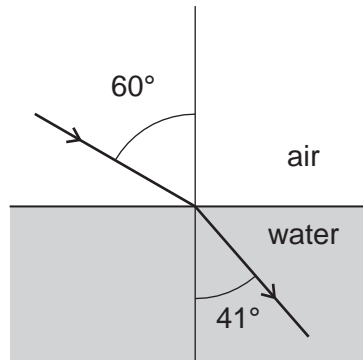


**AS @j Y Physics B**  
**H157/01** Foundations of physics

**Question Set 7**

1. **Fig. 1** shows a ray of orange light being refracted at an air-water boundary.



**Fig. 1**

- (a) Show that the refractive index  $n$  of the water is less than 1.4 using the angles shown on **Fig. 1**.

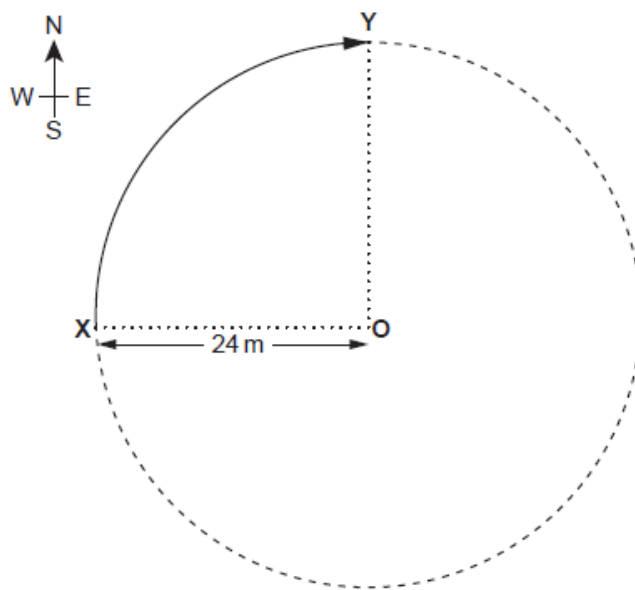
$n = \dots\dots\dots$  [2]

- (b) The refractive index of water for violet light is 0.02 more than the refractive index for the orange light calculated in (a).

State and explain any changes in refraction when violet light enters water at the same angle of incidence of 60°.

[2]

2. Tom runs on the circular track of radius 24 m shown in **Fig. 2**. He starts at point **X** and stops at point **Y**, which is one-quarter of the way around the track.



**Fig. 2**

Calculate Tom's **displacement** from **X** to **Y**. Show your working.

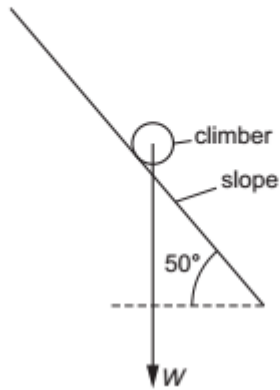
magnitude .....m  
direction .....

**[3]**

3.

Forces can be resolved into components.

**Fig. 3** shows a weight vector  $W$  acting on a climber on an ice slope. The slope is at  $50^\circ$  to the horizontal.



**Fig. 3**

- (a) Add to **Fig. 3** two vector arrows to show the components of  $W$ , parallel to and perpendicular to the slope.

Your diagram should show that the components add up to make the  $W$  vector.

[1]

- (b) The climber of weight  $W = 600\text{ N}$  is held in equilibrium by a rope parallel to the slope.

Calculate the magnitude of the tension in the rope.

magnitude of tension = ..... N [2]

4.

This question applies Newton's laws of motion to a test flight of an aircraft.

The test flight starts with straight level flight at constant velocity. Fig. 4 shows the four initial forces acting on the aircraft.

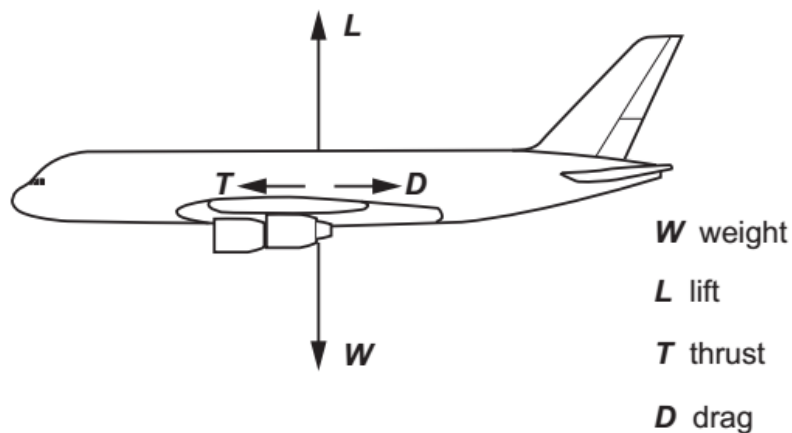
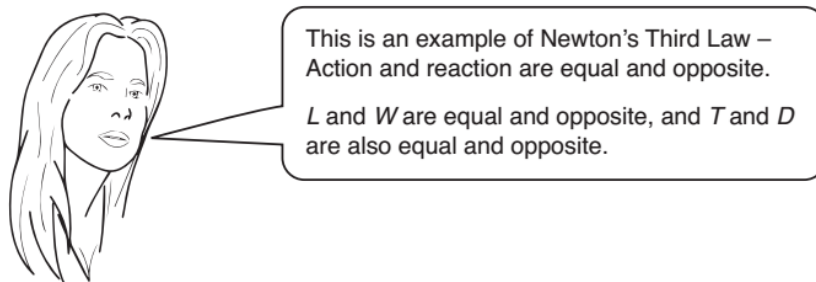


Fig. 4

The lift force  $L$  depends on the velocity  $v$  of the aircraft – as  $v$  increases,  $L$  also increases.

(a) One student has an incorrect interpretation of this diagram.



Using one of the two pairs of forces she mentions ( $L$  and  $W$  or  $T$  and  $D$ ), explain why she is wrong.

[2]

(b) The engines are stopped and the thrust  $T$  becomes zero. The aircraft continues flying.

Explain, using Newton's Laws, how the aircraft will move once the engines have been stopped.

[2]

(c) The mass of the aircraft when its engines are stopped is  $4.0 \times 10^5 \text{ kg}$  and the drag  $D$  is  $1.2 \text{ MN}$ .

Calculate the deceleration of the aircraft just after the engines are stopped.

deceleration = .....  $\text{m s}^{-2}$  [1]

**Total Marks for Question Set 7: 15**



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