AS Level 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.

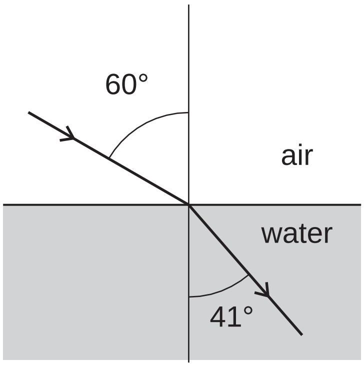


Fig. 1

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

n = ... **[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.

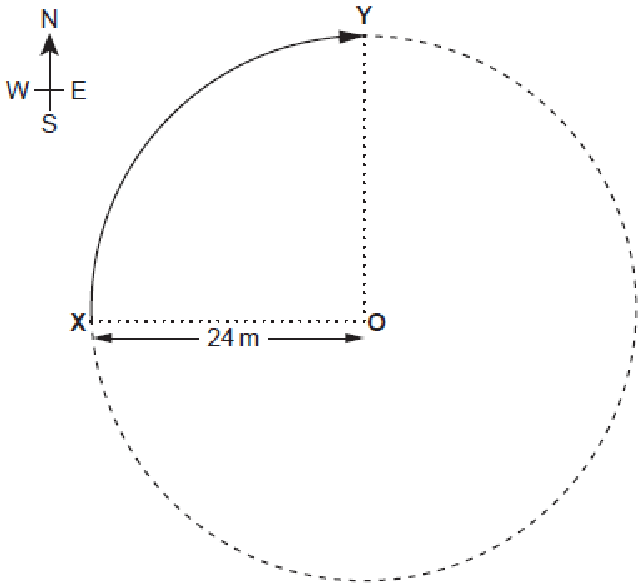


Fig. 2

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° to the horizontal.

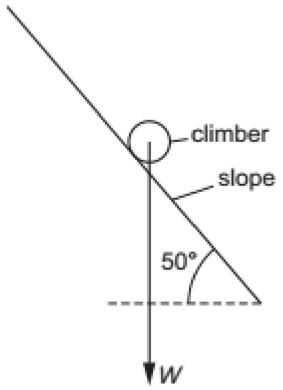


Fig. 3

(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.

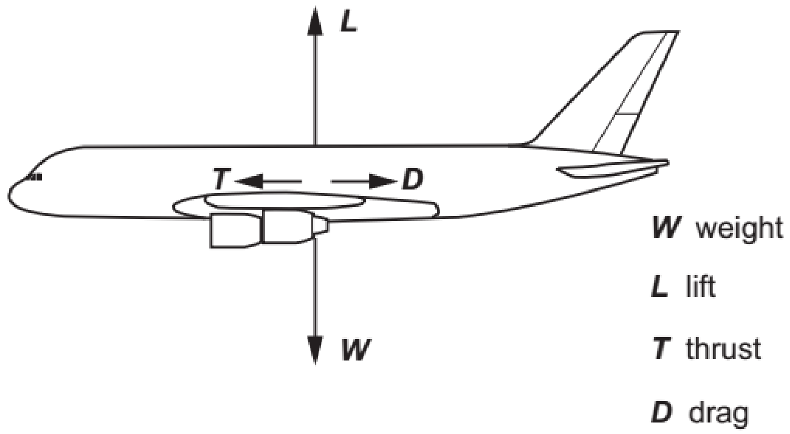
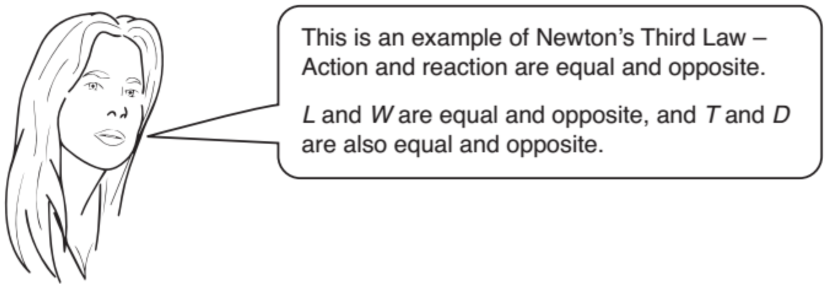


Fig. 4

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 4.0×10^5 kg and the drag D is 1.2 MN.

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

deceleration = ……………………………… m s^{-2} **[1]**

Total Marks for Question Set 7: 15