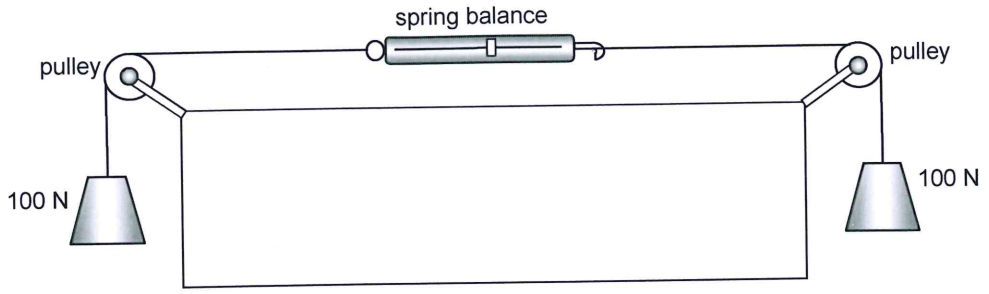
Exam Solutions

Chapter 1·2 - Inclined Planes

Answer 1 2010:1:2

(3 marks)



(a) What is the reading on the spring balance? Circle your answer. (1 mark)

Description	Marks
100 N	1
	Total 1

(b) Choose **one** of the answers that you **rejected** and give your reason. (2 marks)

Description	Marks
If zero then the weight would stay in position without any string being required, if 200 N then the block would accelerate (only one required). Reason **must** explain the selected choice.(**Marks only given for reason**)	1-2
	Total 2

Answer 2 2013:2:17

(12 marks)

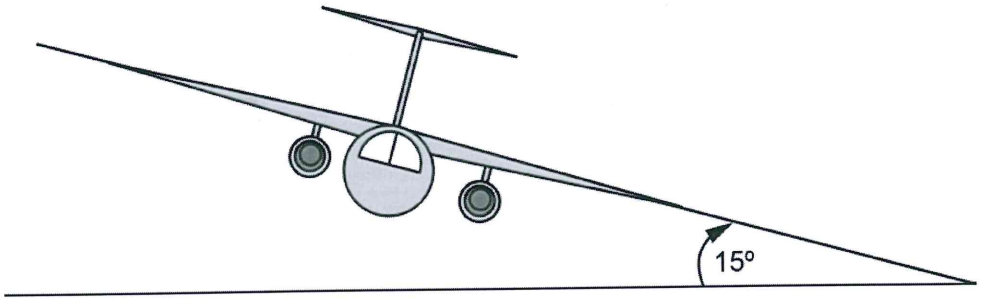
An aircraft is flying horizontally with a constant speed of 600 km h^{-1} at an altitude of 5000 m. The upward (lift) force provided by the wings that is necessary to keep the aircraft in level flight is 9.80×10^4 N.

(a) Show that the mass of the aircraft must be 1.00×10^4 kg. (3 marks)

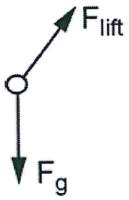
Description	Marks
For the plane to be in level flight, forces need to be balanced $F_{up}=F_g=mg$	1–2
$m=F/g=98000/9.8$ $m=10\ 000$ kg	1
Total	**3**

Exam Solutions
Chapter 1·2- Inclined Planes
Answer 2: continued

(b) The pilot begins a turn by tilting the aircraft so that its wings are at 15.0° to the horizontal as shown. Assume that the airspeed does not change, and that the size and angle to the wing of the lift force remain constant.



Draw a free body diagram below labelling the forces acting on the aircraft. Ignore drag/friction and thrust forces directed into and out of the page. (2 marks)

Description	Marks
 F_{lift} drawn same size as F_g (approximately) Only two forces drawn	1
F_g drawn downwards; F_{lift} drawn perpendicular to wings	1
Total	**2**

(c) Calculate the horizontal radius of the aircraft's turn, assuming the airspeed does not change. (5 marks)

Description	Marks
600 km h^{-1} = 166.67 m s^{-1}	1
F_c = 98 000 Sin 15^0 = 25 364.27 N	1
$F_c = mv^2 / r$ $r = mv^2 / F_c$	1
= (10 000 × 166.67^2) / 25 364.27	1
r = 10 951.97 m = 1.10 ×10^4 m or 11.0 km	1
Total	**5**

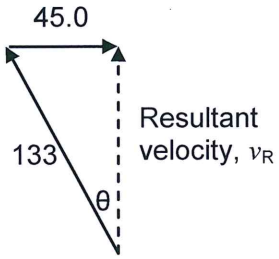
(d) Describe any effects that this turn will have on the altitude of the aircraft. No calculations are required. (2 marks)

Description	Marks
The up and down forces are no longer balanced as the plane turns	1
So the plane's height decreases	1
Total	**2**

Exam Answers
Chapter 1·2- Inclined Planes
Answer 3 2014:1:5

(5 marks)

An aircraft attempts to land along a north-south aligned landing strip. It approaches from the south and has an air speed of 133 km hr^{-1}. The wind is blowing from the west at 45.0 km hr^{-1}. Draw a vector diagram to show the direction the aircraft needs to head and calculate its actual velocity, in m s^{-1}, relative to the runway. Show **all** workings.

Description	Marks
Two vectors drawn at an appropriate angle to each other Resultant shown If directions incorrect, max. 1 mark 	1–2
$133^2 = v^2 + 45^2$ v_R = 125 km hr^{-1} North	1
v_R = 125/3.6= 34.7 m s^{-1} North (direction implied, so not required)	1
$\theta=\sin^{-1}(45/133)=19.8°$ (heading)	1
Total	**5**