Sec 3 Physics Practical 07 ANSWERS

Dynamics: Forces in Equilibrium

Marking Scheme

Results:

(g)   *Table 1*: α, β, T_1, T_2, T_1^2, T_2^2 and Q

Sample data for α + β = 90°

α / °	β / °	T_1 / N	T_2 / N	T_1^2 / N^2	T_2^2 / N^2	Q / N^2
0	90	3.43	0.00	11.8	0.00	11.8
10	80	3.40	0.66	11.6	0.44	12.0
20	70	3.13	1.17	9.80	1.37	11.2
30	60	3.01	1.68	9.06	2.82	11.9
40	50	2.65	2.23	7.02	4.97	12.0
45	45	2.44	2.44	5.95	5.95	11.9

(h)   *Table 2*:

	#	α / °	β / °	T_1 / N	T_2 / N
Q5	1	30	30	2.09	2.02
	2	45	45	2.44	2.44
	3	60	60	3.43	3.40
Q6	4	15	45	2.86	1.05
	5	60	45	2.59	3.16
	6	45	60	3.16	2.59

Questions:

1   State and explain one significant source of error in this experiment.

- There could be human judgment error in reading the angles to the nearest degree, over the printed protractor.

- There could be human judgment error in judging the exact alignment of the junction over the centre of the protractor.

- There could be human judgement error in aligning each string to the length of each hook on the sensor.

- There may be friction over the pulley at the edge (D) of the bench.

*From the results in **Table 1**:*

2   What do you notice about the values of **Q**?

The values of Q are (approximately) the same value.

3   Draw and label a vector triangle to show the forces T_1, T_2 and T_3 at equilibrium when **α** is 40° and **β** is 50° based on the forces shown in **Diagram 1**.
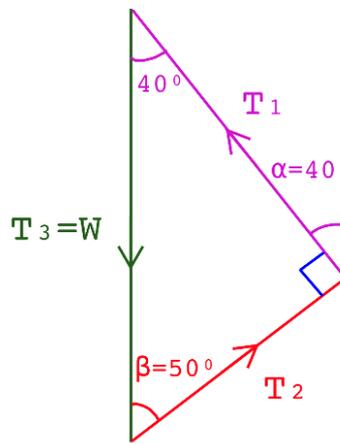
Refer to Diagram 1 plan
(top) view of forces!

4   Determine the weight of the load **L** using the vector triangle in **Q3**.

tension in vertical (hanging) string = weight of load, so $T_3 = W$

From above vector triangle, $T_1{}^2 + T_2{}^2 = T_3{}^2 = W^2$ using Pythagoras' theorem
From step 6, $T_1{}^2 + T_2{}^2 = Q$
Hence, $W^2 = Q$
   From **Table 1**, $Q \approx$ 10 to 12 N
 $W = \sqrt{Q} \approx$ 3.1 to 3.5 N

*From the results in **Table 2**:*

5   Describe any relationships you can deduce from rows #1-3?

- With angles α and β being identical (α = β), the tensions in the two strings are identical ($T_1 = T_2$).

- As the <u>angles (α and β) increase</u> from row #1 to 3, the <u>tensions</u> in the strings also <u>increase</u>.

6   Describe any relationships you can deduce from rows #4-6?

- With angles α and β being different, the tension in the two strings will be different.

- The string with the <u>smaller angle</u> has a <u>larger tension</u>.

***Note**: Compare the relationships deduced in **Q5** & **Q6** with the vector triangle in **Q3**.*