SMART EXAM RESOURCES
9702 PHYSICS TOPIC QUESTIONS
TOPIC: PHYSICAL QUANTITIES AND UNITS
SUB-TOPIC: SCALARS AND VECTORS
SUB-SUB-TOPIC: VECTOR DIAGRAMS
SET-1-QP-MS

1 A block of wood of weight 25 N is held stationary on a slope by means of a string, as shown in Fig. 1.1.

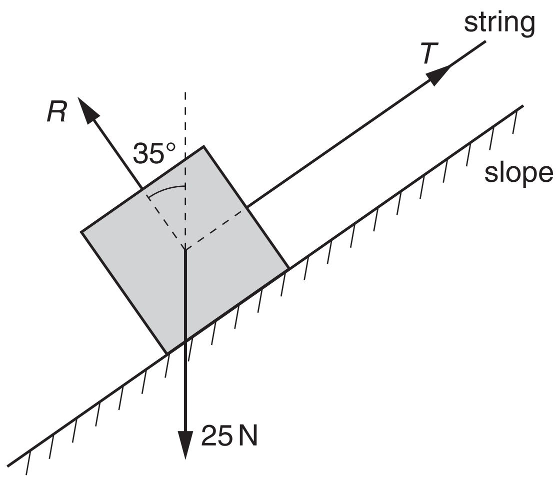

Fig. 1.1

The tension in the string is T and the slope pushes on the block with a force R that is normal to the slope.

Either by scale drawing on Fig. 1.1 or by calculation, determine the tension T in the string.

T = ... N [3]

MARK SCHEME:

either	triangle / parallelogram with correct shape	C1	
	tension = 14 .3 N (*allow* ± *0.5 N*)	A2	[3]
	(*if* > ±*0.5 N but* ≤ ±*1 N, allow 1 mark*)		
or	*R* = 25 cos 35°	(C1)	
	T = *R* tan 35°	(C1)	
	T = 14.3 N	(A1)	
or	*T* = 25 sin 35°	(C2)	
	T = 14.3 N	(A1)	
or	*R* and *T* resolved vertically and horizontally	(C2)	
	leading to *T* = 14.3 N	(A1)	

2 A force of 7.5 N acts at 40° to the horizontal, as shown in Fig. 1.1.

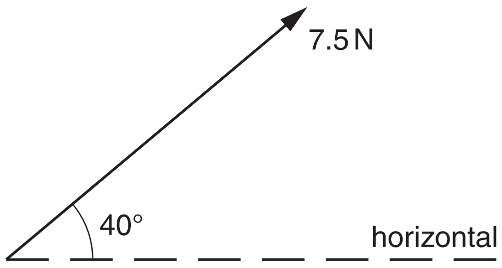

Fig. 1.1

Calculate the component of the force that acts

(i) horizontally,

horizontal component = ... N [1]

(ii) vertically.

MARK SCHEME:

(i)	horizontally:	$7.5\cos 40° / 7.5\sin 50° = 5.7(45) / 5.75$ <u>not</u> $5.8\,N$	A1	[1]
(ii)	vertically:	$7.5\sin 40° / 7.5\cos 50° = 4.8(2)\,N$	A1	[1]

3 Two strings support a load of weight 7.5 N, as shown in Fig. 1.2.

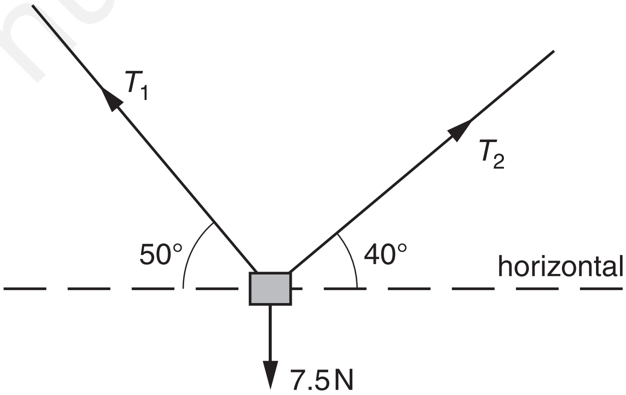

Fig. 1.2

One string has a tension T_1 and is at an angle 50° to the horizontal. The other string has a tension T_2 and is at an angle 40° to the horizontal. The object is in equilibrium. Determine the values of T_1 and T_2 by using a vector triangle or by resolving forces.

T_1 = ... N

T_2 = ... N
[4]

MARK SCHEME:

either	correct shaped triangle	M1	
	correct labelling of two forces, three arrows and two angles	A1	
or	correct resolving: $T_2 \cos 40° = T_1 \cos 50°$	(B1)	
	$T_1 \sin 50° + T_2 \sin 40° = 7.5$	(B1)	
$T_1 = 5.7(45)$ (N)		A1	
$T_2 = 4.8$ (N)		A1	[4]
(allow ± 0.2 N for scale diagram)			

4 **(c)** Two tugs pull a tanker at constant velocity in the direction XY, as represented in Fig. 1.1.

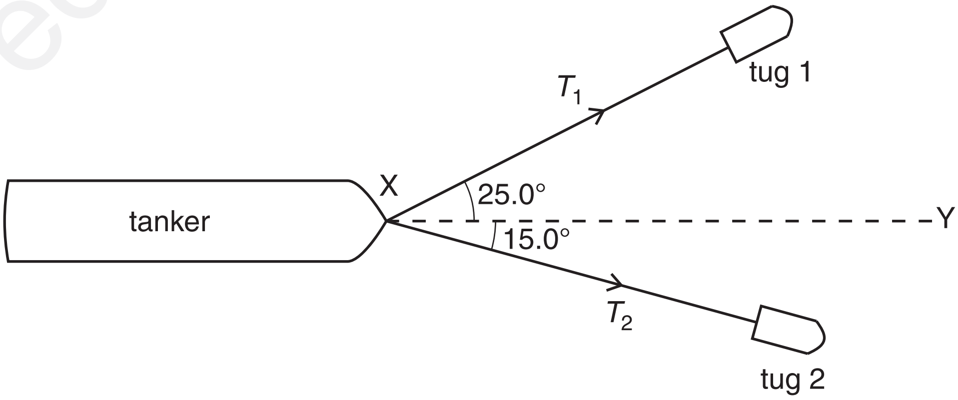

Fig. 1.1

Tug 1 pulls the tanker with a force T_1 at 25.0° to XY. Tug 2 pulls the tanker with a force of T_2 at 15.0° to XY. The resultant force R due to the two tugs is 25.0×10^3 N in the direction XY.

(i) By reference to the forces acting on the tanker, explain how the tanker may be described as being in equilibrium.

....

....

....

.... [2]

(ii) **1.** Complete Fig. 1.2 to draw a vector triangle for the forces R, T_1 and T_2. [2]

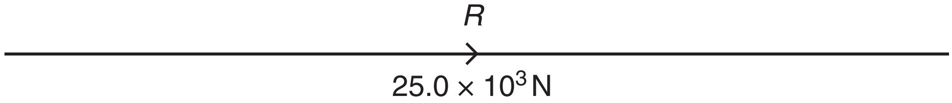

Fig. 1.2

2. Use your vector triangle in Fig. 1.2 to determine the magnitude of T_1 and of T_2.

T_1 = ... N

T_2 = ... N
[2]

(i)	sum of T_1 and T_2 equals frictional force		B1	
	these two forces are in opposite directions		B1	[2]
	(allow for 1/2 for travelling in straight line hence no rotation / no resultant torque)			
(ii)	1.	scale vector triangle with correct orientation / vector triangle with correct orientation both with arrows	B1	
		scale given or mathematical analysis for tensions	B1	[2]
	2.	$T_1 = 10.1 \times 10^3$ ($\pm$ 0.5×10^3) N	A1	
		$T_2 = 16.4 \times 10^3$ ($\pm$ 0.5×10^3) N	A1	[2]

5 The velocity vector diagram for an aircraft heading due north is shown to scale in Fig. 1.1. There is a wind blowing from the north-west.

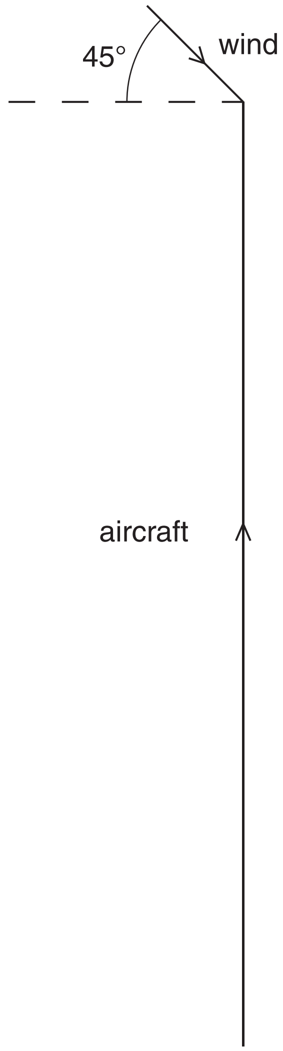

Fig. 1.1

The speed of the wind is 36 m s^{-1} and the speed of the aircraft is 250 m s^{-1}.

(i) Draw an arrow on Fig. 1.1 to show the direction of the resultant velocity of the aircraft. [1]

(ii) Determine the magnitude of the resultant velocity of the aircraft.

resultant velocity = ... m s^{-1} [2]

MARKING SCHEME:

(i)	arrow to the right of plane direction (about 4° to 24°)	B1	[1]
(ii)	scale diagram drawn or use of cosine formula $v^2 = 250^2 + 36^2 - 2 \times 250 \times 36 \times \cos 45°$ or resolving $v = [(36\cos 45°)^2 + (250 - 36\sin 45°)^2]^{1/2}$	C1	
	resultant velocity = 226 (220 – 240 for scale diagram) $m\,s^{-1}$ allow one mark for values 210 to 219 or 241 to 250 $m\,s^{-1}$ or use of formula (v^2 = 51068) v = 230 (226) $m\,s^{-1}$	A1	[2]