Newton's Laws of Motion

Mark Scheme 2

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Dynamics
Sub Topic	Newton's Laws of Motion
Paper Type	Theory
Booklet	Mark Scheme 2

Time Allowed: **65 minutes**

Score: **/54**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a** weight = $m \times g$
= 130.5 × 9.81 = 1280 N A1 [1]

(b) $F = ma$
$T - 1280 = 130.5 \times 0.57$ C1
$T = 1280 + 74.4 = 1350$ N A1 [2]

(ii) 1280 N A1 [1]

(c) $1240 - 1280 = 130.5 \times a$ C1
$a = (-)\ 0.31\ \text{m s}^{-2}$ A1 [2]

(d) **1.** 3.5 s A1 [1]

2. 6.5 s A1 [1]

(ii) basic shape M1
correct points A1 [2]

2 **(a** point at which (whole) weight (of body) (allow mass for weight) M1
appears / seems to act ... (for mass need 'appears to be concentrated') A1 [2]

(b) (i) point C shown at centre of rectangle ± 5 mm [1]

(ii) arrow vertically downwards, from C with arrow starting from the same margin of error as in **(b)(i)** B1 [1]

(c) (i) reaction / upwards / supporting / normal reaction force M1
friction M1
force(s) at the rod A1 [3]

(ii) comes to rest with (line of action of) weight acting through rod
allow C vertically below the rod B1
so that weight does not have a moment about the pivot / rod B1 [2]

3 **(a)** **(i)** force is rate of change of momentum …… B1 [1]

(ii) force on body A is equal in magnitude to force on body B (from A) ……M1
forces are in opposite directions …… A1
forces are of the same kind ……A1 [3]

(b) **(i)** 1 $F_A = -F_B$ …… [1]
2 $t_A = t_B$ …… B1 [1]

(ii) $\Delta p = F_A t_A = -F_B t_B$ …….. B1 [1]

(c) graph: momentum change occurs at same times for both spheres ……. B1
final momentum of sphere B is to the right …….. M1
and of magnitude 5 N s …… A1 [3]

4 **(a)** **(i)** (air) resistance increases with speed M1
resultant / accelerating force decreases ..... A1 [2]

(ii) *either* (air) resistance is zero
or weight / gravitational force is only force ..... B1 [1]

(b) use of gradient of a tangent M1
acceleration = 1.9 ± 0.2 m s^{-2} ..... A2 [3]
(*for values > ± 0.2 but ≤ 0.4, allow 1 mark*)
(*answer 3.3 m s^{-2} scores no marks*)

(c) (**1** weight = 90 × 9.8 = 880 N ..... A1 [1]
(*use of g = 10 m s^{-2} then deduct mark but once only in the Paper*)
2 accelerating force = 90 × 1.9 = 170 N …(*allow ecf*) ..... A1 [1]

(ii) resistive force = 880 – 170 = 710 N ..... A1 [1]
(*allow ecf but only if resistive force remains positive*)

[Total: 9]

5	**(a)**	point where whole weight of body (allow mass)		M1	
		may be <u>considered</u> to act (do not allow 'acts')		A1	**[2]**
	(b)	when CG below pivot, weight acts through the pivot		B1	
		(so) weight has no turning effect about pivot		B1	**[2]**
6	**(a)**	<u>change</u> in velocity/time (taken)		B1	**[1]**
	(b)	velocity is a vector/velocity has magnitude & direction		B1	
		direction changing so must be accelerating		B1	**[2]**
	(c)	*either* 6.1 × cos35 = 4.99 N	*or* scale shown	B1	
		so no resultant vertical force	triangle of correct shape	B1	
		6.1 sin35 = 3.5 N	resultant = 3.5 ± 0.2 N	B1	
		horizontally	horizontal ± 3°	B1	**[4]**
		allow answer based on centripetal force:			
		resultant is centripetal force (which is horizontal)		(B1)	
		resultant is horizontal component of tension		(B1)	
		6.1 sin35 = 3.5 N		(B1)	
		horizontally		(B1)	

7 **(a)** mass: measure of body's resistance/inertia to changes in velocity/motion B1
weight: effect of gravitational field on mass or force of gravity B1
any further comment e.g. mass constant, weight varies/ weight = mg/scalar and vector ..... B1 [3]

(b) e.g. where gravitational field strength changes (change) in fluid surrounding body…. *1 each, max 2* ..... B2 [2]