

- 1 (a) (i) 1.6s to 1.8s ALLOW 4.2 – 6s ALLOW 4.4 – 6s NOT 2s NOT 4.0 – 6s B1
- (ii) 6 – his (i), evaluated ALLOW 0 – 4.2s ALLOW 0 – 4.4s NOT 0 – 4s e.c.f. B1
- (iii) his (i) × 20 C1  
 32 – 36m or his (i) × 20 evaluated  
 allow B1 only for 40m with no working A1
- (iv) area under whole graph or  $\frac{1}{2}vt + \text{his(iii)}$  C1  
 70 – 95m A1
- (b) (i) weight of ball down and (air) resistance up )  
 OR friction opposes weight )  
 upward/resistance/friction force increases )  
 with time/distance/speed/as ball falls ) any 3 B1×3  
 net force reduces )  
 less force, so less acceleration )
- (ii) up force = down force OR no resultant force OR air res. = weight B1  
 no net force, no acceleration/constant speed B1

**[Total: 11]**

2	(a)	acceleration, speed increases acceleration getting less acc. zero/constant speed along RT or terminal velocity	B1 B1 B1	3
	(b)	air resistance or friction (force) up (accept upthrust) weight/(force of) gravity down	B1 B1	2
	(c)	air resistance (up) = weight (down) or two forces equal no (net) force, no acceleration	B1 B1	2
	(d)	distance = speed x time or 120 x 40 distance = 4800 m	C1 A1	
	(ii)	distance = average speed x time or 25 x 6 or area under graph distance = 150 m	C1 A1	4
				<b>[11]</b>

3	(a)	time a number of swings (if number stated, >5) time divided by [2 x number of swings]	M1 A1	2
	(b) (ii)	weight of gravity and tension force towards centre of circular motion or towards support point	B1 B1	2
	(c)	p.e. = mgh or $0.2 \times 10 \times 0.$ = 0.1 J	C1 A1	2 [6]

4	(a)	force of gravity on a mass or mg mass/volume	B1 B1	[2]
	(b) (i)	hang object from spring balance, reading in N taken divide reading in N by 10 or g	B1 B1	
	(iii)	volume of water in cylinder or fill overflow can to top add object find increase in volume or measure overflow volume {no credit for mass unless not scored in (i) and no credit for density = mass/ volume unless not scored in a) }	B1 B1	[4]
	(c)	2N left	B1 B1	
	(ii)	$F = ma$ or $2 = 0.5 a$ $a = 4.0 \text{ m/s}^2$	C1 A1	[4]
				<b>Total [10]</b>

5 (a) (i)	7(.0 s)	A1	
(ii)	PQ or 0 – 2s or other correct description	A1	
	distance = av. speed x time or area under graph	C1	
	distance $11 \times 2 \text{ m} = 22 \text{ m}$	A1	4
(b) (i)	deceleration (now) uniform (test 2)	B1	
	slower/lower (average) value/value between that of PQ and QR/takes longer (or values) time to come to rest.	B1	
(ii)	deceleration = change in speed/time or $15/8$	C1	
	value = $1.9 \text{ m/s}^2$	A1	4
(c) (i)	graph shows constant acceleration	B1	
	force = ma (and m is also constant) so force is constant	B1	
(ii)	towards the centre of the motion/circle	A1	

[11]