1 Ignore upthrust throughout this question

(a) paper:
drag / air resistance / friction (upwards) (seen anywhere in **(a)**) B
drag /air resistance / friction = weight / force of gravity B1
no resultant (force) / forces balance / upwards force = downwards force
AND no acceleration B1

coin:
weight / force of gravity (always) bigger than air resistance
OR force down bigger than force up
OR air resistance hasn't time / distance to equal weight B1

(b) fall at same speed / acceleration / rate, ignore fall at same time)
hit bottom at same time/together)
paper now accelerates (all the way)) any 1 B1
paper no longer flutters side-side)
they/paper NOT coin fall(s) faster)
the paper (ignore coin) hits sooner)
NOT constant speed/rate [5]

2 **(a (i)** $(v - u)/t$ OR v/t OR 8/3 C1
2.7 m/s^2 A1

(ii) *ma* OR 42 × answer from **(i)** OR 42 × 8/3 C1
110/112 N e.c.f. A1

(iii) (distance in 1st 3 secs =) 12 m OR (dist in last 3 secs =) 88 m C1
use of area of trapezium OR area of "top" triangle C1
7.7 m/s A1

(b) longer time to top speed)
longer total time)
lower top speed)
lower finishing speed) any 2 B1+B1
specific/all speeds lower (**not** speed decreases))
less slope/less acceleration (in first section))
greater slope/greater deceleration in 2nd section)

[Total: 9]

3 **(a) (i)** straight line OR constant gradient / slope OR
change in speed with time constant OR speed proportional to time B1

(ii) increase in velocity / time OR $a = v/t$, symbols, words or numbers C1
0.75 m/s^2 A1

(b) (i) decreases OR acceleration slows (down) NOT 'it slows down' C1

(ii) equal to forward / downward force / force down slope OR
constant / maximum OR (giving) no resultant force C1
equal to component of weight (down slope) A1

(iii) 1 graph starting at origin B1
curved from start AND decreasing gradient AND
horizontal final part B1

2 label A on any correct curved region B1
label B on horizontal region B1 [10]

4 **(a) (i)** v/t or (v-u)/t or 28.5/3 or his correct ratio C1
9.3 to 9.5 m/s^2 A1

(ii) area under graph or 0.5 × 3 × 28.5 or ½b×h C1
42 to 44 m (allow reasonable e.c.f.) A1

(iii) 15 m/s B1

(b) (plastic ball larger so) upward force/air resistance/drag more (or vice versa for rubber ball)
IGNORE wind resistance B1
rubber ball, this force not big enough to balance weight/gravity (force) B1
plastic ball, upward force/air resistance big enough to balance/equal weight/gravity (force) B1

(c) mg or 0.05 × 10 or 50 x 10 accept 9.8 or 9.81 instead of 10 C1
0.5 N or 0.49N or 0.4905N nothing else A1

[10]

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 x 2 m= 22 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 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]

Accept D≈E
marked on time axis
No labels -1

6 a	BD correct, (straight line i.e. constant acceleration)		B1	
	DE correct, (constant speed or slightly reducing speed only)		B1	
	EF correct, (speed reduced to zero, gradient steeper than BD)	3	B1	3
b(i)	force = 2 (N)		C1	
	work = (2 x 0.6) = 1.2 J*	2	A1	
(ii)	k.e. = 0.5mv^2		C1	
	= 0.5 x 0.2 x 2.5 x2.5		C1	
	= 0.625 J*	3	A1	5
c	velocity - vector, speed scalar		B1	
	direction changes so velocity changes	2	B1	2
d	work done against friction		B1	
	(more) friction on EF		B1	
	(k)e. changed to heat		B1	
	less k.e. changed to p.e.	3	B1	M3