PreDP revision questions answers for Section B of the exam

Unit 1 and 2: Measurements and Forces and Motion

check zero on stopwatch OR repeat OR other sensible precaution	B1	
start stopwatch at some recognisable point in the cycle	B1	
stop stopwatch after at least 10 cycles OR count no. of cycles in at least 10 s	B1	
divide time by number of cycles	B1	[4]

(a) micrometer OR screw gauge OR vernier scale NOT vernier callipers — B1

(b) 2.73 mm — B1

(c)

check/set zero)		
close instrument on to paper)		
not too tight/use ratchet)	any 3	B1 × 3
take reading of both scales)		
use several sheets)		
divide reading by no. of sheets)		

[5]

(a)

measuring cylinder with liquid	B1
immerse statue	B1
volume from difference of readings from measuring cylinder	B1
OR	
displacement can/equivalent/beaker, <u>filled to overflowing</u> with liquid	(B1)
immerse statue	(B1)
measure volume displaced <u>with measuring cylinder</u>	(B1)

(b)

(D =) M/V OR 600/65	B1
9.23 g/cm^3 (minimum 2 s.f.) N.B. unit penalty applies	B1
OR	
(For gold) (M =) V × D OR 65 × 19	(B1)
1235 g (minimum 2 s.f.) N.B. unit penalty applies	(B1)
OR	
(For gold) (V =) M / D OR 600/19	(B1)
31.6 cm^3 (minimum 2 s.f.) N.B. unit penalty applies	(B1)
'NO' ticked if justified by previous work in **(a)** or **(b)**.	
e.c.f from wrong values above	B1

[6]

(a) Period: 1.81 s OR 1.8 s as mean value
OR 1.8 s as most common reading / the mode — B1

(b) Time a minimum of 2 (successive) oscillations — B1
Divide result by the number of oscillations — B1
OR
Count no. of oscillations in at least 20 s — (B1)
Divide the time by the number of oscillations
OR Divide no. of oscillations by time and find reciprocal — (B1)
2 of:
Repeat (several times) and find mean
Time with reference to fixed / fiducial point or top or bottom of oscillation
Check / set zero of stop-watch
Show knowledge of what is meant by one oscillation — B2

(a) (density =) mass/volume OR mass per unit volume
OR m/V with symbols explained — B1

(b) **(i)** (vol =) mass/density OR 60.7/2.70 — C1
= 22.48 cm^3 to 2 or more sig. figs — A1

(ii) $V = A \times$ (average) thickness OR thickness = V/A
OR 22.48 / (50 × 30) — C1
0.01499 cm to 2 or more sig. figs. e.c.f. **(b)(i)** — A1

(c) **(i)** micrometer/screw gauge / (vernier/digital) callipers — B1

(ii) check zero of device used / cut sheet into several pieces / detail of how to use device / fold sheet — B1

measure thickness of sheet in different places
OR measure thickness of several pieces together — B1
calculate/obtain average thickness OR divide answer by number of measurements/ pieces/places — B1

(a) (density =) mass / volume B1

(b) water used in measuring / graduated cylinder B1

volume of water known or read / recorded / taken B1

place the coins in the water and read / record / take new level of water in cylinder B1

subtract readings B1

OR ALTERNATIVE METHOD:
pour water into displacement can to level of spout (B1)

place the coins / several coins in the water (B1)

collect overflow (B1)

measure volume of overflow water using measuring graduated cylinder (B1)

measure mass / weigh the coins used with balance / spring balance B1

(a) (if no diagram, max. mark is 3)
measuring / graduated cylinder B1

water **AND** initial reading **OR** known volume
alternative method: water **AND** filled eureka can owtte B1

immerse stone **AND** final reading
alternative method: immerse stone **AND** catch overflow B1

final reading – initial reading
alternative method: reading on measuring cylinder B1

(b) **(i)** mass, **NOT** with other quantity B1

(ii) ($\rho =$)m / V in symbols or words B1

(c) attach weight to wood
OR different liquid
OR push down with stick M1

accuracy mark must match method
subtract volume of weight from total volume
OR new liquid less dense than wood
OR no part of stick in water / thin stick A1

(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]

(a) in direction of the force Do not accept forward on is own. B1

(b) changes direction / causes acceleration / stops straight line motion / keeps object from leaving circle / keeps path circular / pulls object into circle B1

(c) (i) 1. 600 N B1
2. same as his 1. accept 600 N if no value given in **(c) (i)** 1. B1

(ii) ma OR 60 × 2.5 C1
150 N A1

(iii) 750 N e.c.f. from **(c) (i)** 2 and/or **(c) (ii)** B1

(iv) same as his **(c) (i)** 2 accept 600 N if no value given in **(c) (i)** 2. B1

[8]

(a) decreases / braking / decelerating)
constant / steady / nothing) all 3 B1
increases / accelerate)

(b) speed x time in any form, symbols, numbers or words
OR any area under graph used or stated C1
13 (m/s) OR 24 (s) seen or used in correct context C1
312 m A1

(c) rate of change of speed OR gradient of graph OR 18/12 C1

18 (m/s) OR 12 (s) seen or used in correct context C1
1.5 m/s^2 A1

(d) <u>same</u> gradient / slope OR equal speed changes in equal times OR
allow graph symmetrical B1 [8]

(a) **(i)** constant/steady/uniform speed/velocity OR speed/velocity = 2.5 (m/s) B1
speed/velocity = 2.5 m/s accept fraction, average speed/velocity = 2.5 m/s B1 [2]

(ii) shape curving upward but not to vertical, at least to 3.5 s unless reaches 25 m B1 [1]

(b) horizontal (straight) line OR careful sketch
accept parallel to time/*x*-axis B1 [1]

(c) tolerance on both axes ± ½ small square throughout both parts

(i) horizontal straight line at 2.5 m/s from 0 to 2 s, ecf from **(a)(i)** B1

(ii) straight line rising to the right as far as the edge of the graph area M1
Δv = 4 m/s or gradient clearly 2 m/s^2 A1 [3]

(d) <u>horizontal</u> (straight) line M1
at 0 m/s A1 [2]
accept for both marks: line in/along time/*x*-axis OR <u>line</u> with $y/v = 0$ OR careful sketch

(a)	**(i)**	Increasing speed / acceleration	B1
	(ii)	Constant / steady / uniform speed or motion	B1
	(iii)	Decreasing speed / deceleration / braking / slowing / stopping / negative acceleration	B1
(b)	**(i)**	(Total) distance / (total) time OR d / t OR 400 / 60	C1
		6.67 m/s at least 2 s.f.	A1
	(ii)	Mention of maximum gradient OR clear that whole or part of B to C is used	C1
		Use of correct data from graph to +/– ½ square	C1
		Answer rounds to 9.2 to 9.4 m/s, at least 2 s.f.	A1

(a)	**(i)**	a time from 12.5 – 14.9 s **or** 15.1 – 16.0 s *Unit penalty applies	B1	
	(ii)	a time from 0 – 2.5 s **or** 14.9 – 15.1 s *Unit penalty applies	B1	
	(iii)	a time from 2.5 – 12.5 s *Unit penalty applies	B1	
(b)		(initially) weight/force of gravity **and** <u>air</u> friction/resistance act	B1	
		it speeds up/accelerates **and** (air) friction/resistance increases	B1	
		reaches terminal/constant velocity	B1	
		(air) friction/resistance = weight **or** no resultant (force) **or** forces in equilibrium	B1	
(c)		upwards	B1	**[8]**

*Apply unit penalty once only

(a) (i) $v = u + at$ OR $(a =)\ (v - u)/t$ OR $24 = a \times 60$ OR $24/60$ C1
$0.4(0)\,m/s^2$ A1

(ii) $(F =)\ ma$ OR $7.5 \times 10^5 \times 0.40$ C1
300 000 N OR 300 kN A1

(b) (i) in words or symbols $(P =)\ W/t$ OR F x d / t OR Fv
OR $7.2 \times 10^4 \times 24 / 1$ OR OR $7.2 \times 10^4 \times 24$ C1
1.7×10^6 W A1

(ii) gravitational/potential energy of train has to be increased
OR force acts down the slope / backward force acts (on train) B1

(for the same distance moved) more work done has to be done OR energy has to be provided (by the engine) B1
in the same time (so needs more power) B1

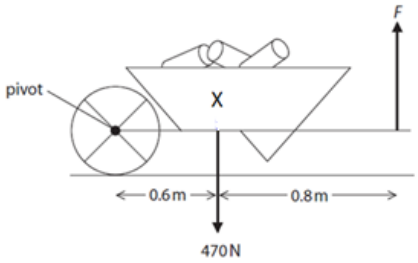
(a) (i)	Terminal (velocity);		1

(ii)	upward force = downward force / forces balanced / no resultant force / resultant force = 0;
	reference to F = ma / reference to (Newton's) 1st or 2nd Law;
	no acceleration / acceleration = 0;
		IGNORE descriptions of *reaching* terminal velocity	3

(iii)	faster speed / higher velocity / fell more quickly; Any one of – smaller (surface) area; Initially less resistive force / air resistance / drag; different time (to reach terminal velocity); less deceleration (before reaching terminal velocity);	 NOT ACCEPT '<u>no</u> air resistance' IGNORE upthrust	2
(b)	(Stopping distance) increased / further / longer; Suitable reason, e.g. Since less braking force / air resistance / drag / takes longer to decelerate / reduced deceleration / smaller resultant force;	IGNORE references to 'longer time' must be comparative, e.g. less / slower / longer	2

(a)	(stopping distance =) thinking distance + braking distance	Could be reversed	1
(b)	Any two of: as speed increases / car goes faster, the (thinking/braking/stopping) distance increases; as thinking distance increases so does braking distance; difference in pattern between thinking/braking distances identified; e.g: increase in thinking distance < increase in braking distance / increase in thinking distance is linear or proportional / increase (in braking / stopping) is non linear / WTTE	Ignore references to time Allow use of values from graph Reject: thinking distance proportional to braking distance	2
(c)	30 (m)	ALLOW any value from 28 to 32 m	1

(a)	(i)	Substitution; Calculation; e.g. m x g = 0.454 x 10 = 4.54 (N)			2
	(ii)	Centre of gravity;	Centre of mass;		1
(b)	(i)	force upwards; from top of nail;	Near vertical by eye In line with F_2		2
	(ii)	Any two from: increase F_1 OR increase force (from hand); Increase d_1 OR increase distance of hand from pivot; Keep F_1 perpendicular to hammer;	use two hands use longer handle use longer hammer Ignore: references to d_2 distance from nail to pivot idea of bigger [rather than longer] hammer		2
				Total	**7**

(a)	(i)	work done = force × distance (moved);	Accept correct symbols e.g. W = F x d W = F x s	1
	(ii)	substitution; evaluation; e.g. (work =) 140 × 39 5500 (J)	 5460	2
	(iii)	same answer as 5(a)(ii)	allow 'the same'	1
(b)	(i)	X in line with the weight arrow and vertically between the tail of the arrow and the top of the wheelbarrow (not including the logs);  	judge alignment with weight arrow by eye	1
	(ii)	moment = force × (perpendicular) distance (from pivot);	condone M = F x d M = F x s	1
	(iii)	principle of moments (stated or implied); total distance hand to pivot calculated; substitution showing either correct moment (or both); final rearrangement and evaluation; e.g. (total) clockwise (moment) = (total) anticlockwise (moment) (distance) = 0.6 + 0.8 = 1.4 m 470 × 0.6 = F × 1.4 F = 470 × 0.6 / 1.4 = 200 (N)	 accept 1.4 or 0.6 + 0.8 seen in working accept 282 seen in working allow 201, 201.43 350, 352, 353, 352.5 gets 2 marks	4

(a)	momentum = mass x velocity OR 72 x 8 ; Calculation 580 (kg m/s);	Or equivalent rearrangement ACCEPT use of standard abbreviations i.e. p = mv ALLOW 576 (kg m/s)	2
(b)	Substitution 920 ÷ 0.17 ; Calculation 5400 (N) ;	REJECT Alternative incorrect unit for 1 mark ACCEPT 5410 / 5412 / 5411.7…… 5411.8 REJECT 5411	2
(c) (i)	Any **two** from: <u>Road</u> Weather-related e.g. wet / dry / rainy / icy ; Surface-related e.g. gravel / mud / freshly tarmaced / oily ; Gradient e.g. uphill / downhill ; <u>Car</u> Mechanical e.g. quality of tyres / brakes ; Momentum-related e.g. speed / number of passengers / mass ; <u>Driver</u> State of alertness e.g. tired / alcohol / drugs / mobile phone / other distractions ; Reaction time ;	ALLOW slippery if qualified	2

(a) (i)	momentum = mass x velocity;			1
(ii)	Substitution into correct equation; Calculation; e.g. momentum = 0.15 x 6 = 0.9;; Unit: kg m/s;	kg ms^{-1} Ns		3
(iii)	0.9 = (0.15 + 0.05) x v; v = 0.9 ÷ 0.2 = 4.5 (m/s);	Ecf from 8(a) (ii) (i.e. answer for 8aii ÷ 0.2 or answer for 8aii x 5)		2
(b)	The student is wrong; Because variables are not controlled; e.g. mass of cloth different, mass of (other) tins different, cloth velocity not measured	Student is right if the mass of the second cloth is 0.3 kg;; Student is right if the momentum of the second cloth is 1.8 kg m/s;; (assuming all tins are 0.05 kg/ throws new cloth with exactly the same velocity)		2

(a)		Area under the graph (from 0 s to 3 s) ;	6 x 3 or 18 (m); area shaded on graph		1
(b)	(i)	Momentum = mass x velocity;	*p*= *m x v* ; accept rearrangements		1
	(ii)	Substitution in correct equation; Calculation; e.g. 6.4 x 6 = 38.4 kg m/s ;	Ns;		3

(c)	(i)	4.8 (m/s) ;			1
	(ii)	Idea that momentum is conserved; Substitution; Calculation; e.g. $p_1 = p_2$ / $m_1 \times v_1 = (m_1 + m_2) \times v_2$ $6.4 \times 6 = (6.4 + m_2) \times 4.8$ $m_2 = (38.4 \div 4.8) - 6.4 = 8 - 6.4$ $= 1.6$ (kg)	Allow e.c.f. from incorrect momentum calculation in (b)(ii) and /or incorrect velocity reading e.g.: Idea of conservation of momentum; m_2 = [(b)(ii) ÷ (c)(i)] – 6.4 ; correct evaluation of this; e.g. 5 m/s → 1.28 kg Allow for one mark - A calculation that only leads to total mass e.g. = 8 kg;		3
				Total	**9**