Paper 1

Q1 ~ 10	В	В	С	В	С	С	В	Α	Α	D
Q11 ~ 20	В	D	С	В	D	С	D	В	В	С
Q21 ~ 30	С	С	D	С	Α	D	В	С	D	D

Paper 2 Section A

- 1 (i) s = area under graph = ½ x 3.0 x 6.0 = <u>9.0 m</u> (ii) s = area under graph = ½ x 10.0 x 6.0 = **30 m**

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(iii)



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2 (a) Zero newtons.

(b)

The man is moving with constant velocity. By Newton's first law, there is no net force acting on the man.

10

<u>time</u>

OR The man moves with zero acceleration therefore, by Newton's second law, there is no net force acting on the man.



- (c) Since the man is travelling at constant velocity, the forces acting on him must remain balanced. Therefore, the forces acting on him will be the same as those drawn in part (b).
- (a) (i) C.G. lies on the left of the pivot, somewhere 3 along the centre.



(a) (ii) The weight provides an anticlockwise moment about the pivot. The resultant moment causes the toy to rotate anticlockwise. The toy oscillates (swings back and forth) for a while and eventually returns to its original position.

- (b) The weight of the toy acts through the pivot / does not provide any turning moment such that the toy experiences no net moment. The normal contact force exerted by the floor on the toy will also balance the weight of the toy, thus, there will be no net force acting on the toy. The toy is able to stay in equilibrium.
- (i) Gain in GPE = 400 x 10 x 14 Δ = <u>56 000 J</u>
 - (ii) Total energy = KE at bottom $= \frac{1}{2} \times 400 \times (20)^{2}$ = 80 000 J

KE at H = 80 000 - 56 000 = 24 000 J

(iii) $\frac{1}{2}$ mv² = 24 000 $v^2 = 120$ Speed of the cart at the highest point = 11 m/s



- 6 (a) 1. The light ray goes from an optically denser medium to an optically less dense medium.
 - **OR** 1. The light ray goes from a medium with higher refractive index to a medium with lower refractive index.

2. The angle of incidence is greater than the critical angle.

(b) (i) n = sin (90° - 48°) / sin 28° = 1.4 (2 s.f.)

(iii) The light ray is partially reflected at the boundary OR of the light energy is absorbed by the liquid



- (b) From the diagram, $f = 3.3 \pm 0.3$ cm
- (c) The image size decreases / is diminished.

Section B

- 8 (a) (i) v = u + at v = 17 + 2.0 (1.0) v = 19 m/s
 - (a) (ii) $s = ut + \frac{1}{2} at^2$ $s = 17 (1.0) + \frac{1}{2} (2.0) (1.0)^2$ s = 18 m
 - (a) (iii) No, it is not wise because the traffic light will turn red before Jane passes the start of the junction. 18 m > 25 m.
 - (b) (i) $v^2 = u^2 + 2as$, Take right as positive 0 = 17² - 2 (7) s s = 20.6 m
 - (b) (ii) Yes, it is wise because Jane is able to stop safely before the junction. 20.6 m < 25 m.
 - (c) (i) Due to Jane's reaction time, she will travel at 17 m/s for an additional 0.5 s before starting to decelerate.
 Additional distance travelled = 17 x 0.5 = 8.5 m Total distance = 20.6 m + 8.5 m = 29.1 m
 - (c) (ii) She should **slow down** as she approaches the junction and not wait until the light turns amber before she responds.

9 (a) Method 1: Calculation

$$\theta = \tan^{-1}(700/500) = 54^{\circ}$$

T = $\sqrt{(500^2 + (700^2)) = 860}$ N





10 EITHER (a) (i) 0 Nm (a) (ii) Taking moments about the girls' feet, Clockwise moment = ACW moment 485 (0.85) = *F* (1.35) *F* = 305 N

- (b) The girl needs to exert <u>a force less than her own</u> weight to do an inclined pull up compared to a vertical pull up, which requires her to exert a force equivalent to her weight
- (c) (i) Gain in gravitational potential energy = mgh = 485 (0.12) = 58 J (2 s.f.)
- (c) (ii) Yes, it is more tiring because the girl has to do more work against gravity / use more energy / gain more g.p.e. in the case of a vertical pull up compared to an inclined pull up.
- (d) (i) In real life, Work done by girl = 100/20 x 58.2 J = 290 J (2 s.f.)
- (d) (ii) The energy is mostly <u>converted to heat in the</u> <u>muscles</u>
- 10 OR
 - (a) (i) n = sin i / sin r sin r = sin i / n = sin 35° / 1.57 r = 21°

(ii) Emerging ray parallel to incident ray Refracted ray with angle of refraction smaller than angle of incidence



- (iii) an object outside the glass window appears to be slightly higher than its true position /slightly nearer than its true position /slightly dimmer than without glass
- (b) (i) Light travels at almost <u>the speed of light</u> in the optical fibre, much <u>faster than electrical current</u> in the copper wire.
 - (ii) 1. light energy2. electrical energy
 - (iii) total internal reflection
 - (iv) the refractive index of glass is greater than that of the plastic coating

End of paper