WJEC EDUQAS A-LEVEL PHYSICS · COMPONENT 1

PHYSICS



EXAM QUESTION PACK

1.1 BASIC PHYSICS

SCORE	PERCENTAGE
/46	%

STEMUP

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#1

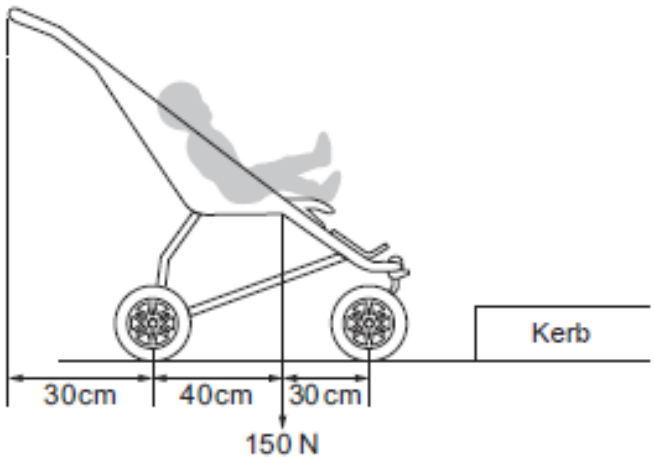
6. *(a)* State what is meant by the centre of gravity of an object. [1]

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(b) A baby is being pushed in a buggy as shown below. The baby and buggy have a combined weight of 150 N.



(i) The father moves the buggy from the road over the kerb. By taking moments about the rear wheel of the buggy calculate the vertical downward force on the handle that would be needed to just lift the front wheel. [2]

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(ii) The father finds it a lot easier to turn the buggy around and, using the handle, lift the back wheel onto the kerb while keeping the front wheel on the ground. Explain why the father finds this new approach easier and justify your answer with a calculation. [3]

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(iii) Describe two ways in which you could alter the design of the buggy in order to make it more stable. [2]

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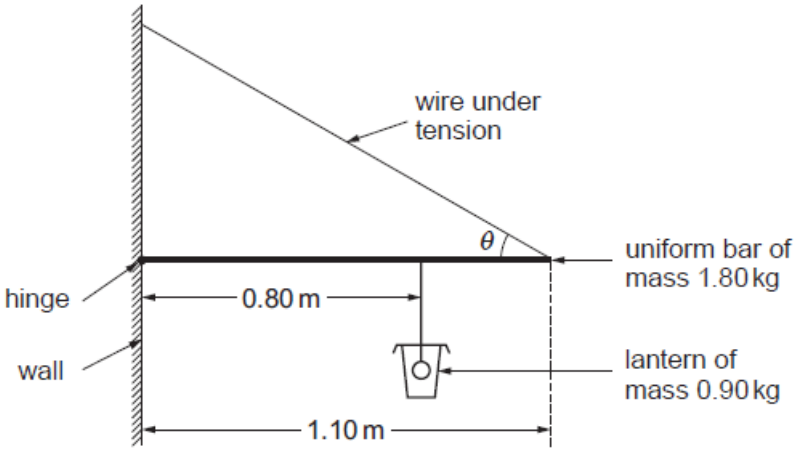
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Question taken from Eduqas examination paper 842001, June 2018

#2

A lantern is suspended from a hinged horizontal metal bar, as shown in the diagram.



(a) (i) Calculate the sum of the clockwise moments about the hinge of the forces acting on the bar. [3]

(ii) For an angle, θ, of 35°, calculate the tension in the wire. [2]

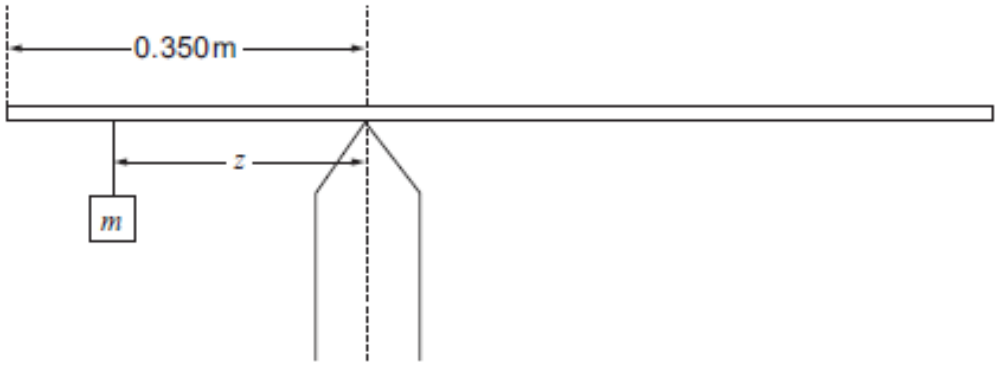
(iii) Discuss the effect, if any, on the tension of making the angle θ smaller (by using a shorter wire and attaching it to a lower point on the wall). [2]

(b) A physics student, Sundeep, calculates that if the wire breaks, then, 0.10 s after it breaks, the angular velocity of the bar about the hinge would be 1.3 rad s^{-1}. Calculate the speed of the tip of the bar (right hand end) when it has this angular velocity. [1]

Question taken from Eduqas examination paper 842101, June 2017

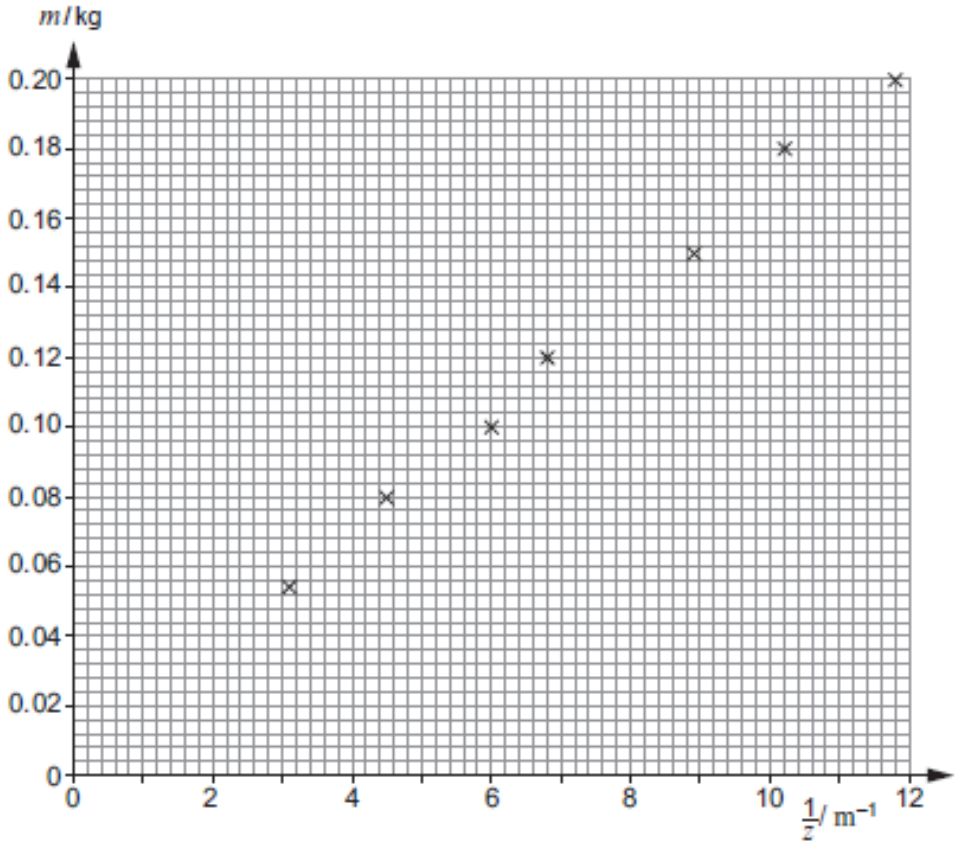
#3

6. Nathan pivots a uniform metre ruler at 0.350 m from one end. He hangs a mass, m, from the ruler and moves the mass along until the ruler balances.



He records the distance, z (see diagram) and repeats the experiment with different masses, keeping the pivot in the same position on the ruler.

He plots m against $\frac{1}{z}$ on the grid below.



(a) Nathan correctly believes that m and z are related by the equation:

$$mz = M \times 0.150$$

in which M is the mass of the ruler and z is in metres.

Explain, in terms of moments, why this equation is correct. [3]

(b) Determine from the graph the best value for M, showing your working. The uncertainty is not required. [4]

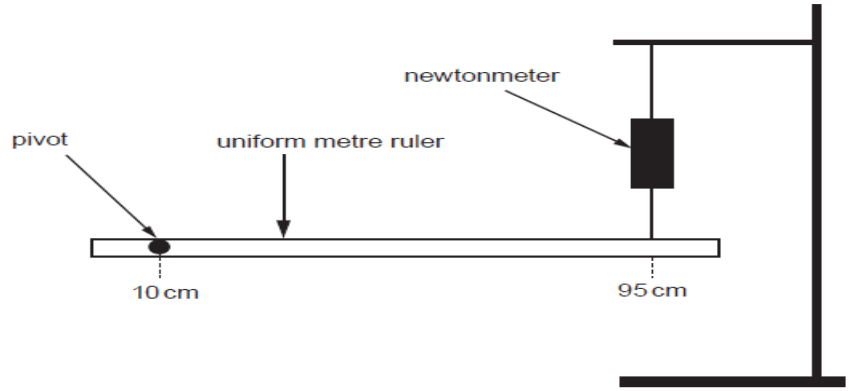
(c) Discuss whether or not Nathan could have obtained readings for lower values of m than 0.050 kg, for the pivot in the same position on the ruler. [2]

Question taken from Eduqas examination paper 842101, June 2018

#4

(a) Explain, with the aid of a diagram, what is meant by the *moment* of a force about a point. [2]

(b)



(i) A uniform metre ruler is pivoted at the 10 cm mark and the other end is supported by a newtonmeter attached to the 95 cm mark. The ruler balances horizontally when the newtonmeter reads 0.8 N. Determine the **mass** of the ruler to an appropriate number of significant figures. [3]

(ii) A mass of 0.5 kg is now added at the 70 cm mark on the ruler and the ruler is adjusted to be horizontal once more.

I. How could you check the ruler is horizontal? [1]

II. What is the new reading on the newtonmeter when the ruler is horizontal? [2]

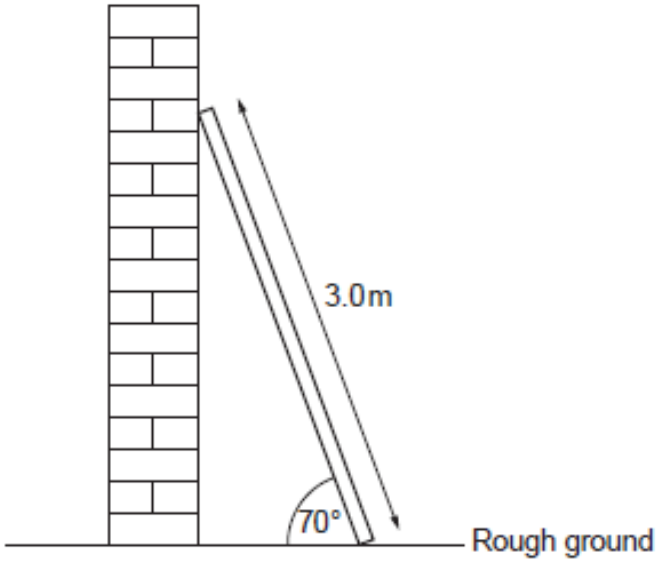
(c) If a uniform metre ruler of greater mass than the one in part *(b)* were used, describe how you could alter the apparatus so the ruler is horizontal once more. Explain your reasoning. [2]

Question taken from Eduqas examination paper 842001, June 2017

#5

5. *(a)* Describe how you could determine the mass of an unknown object using only a metre ruler, pivoted at the 30 cm point, and a known mass. Assume both the known and unknown masses are similar to the mass of the metre ruler. **You cannot change the position of the pivot.** [6 QER]

(b) A uniform ladder of length 3.0 m and mass 30 kg rests against a frictionless wall at an angle of 70° to the ground as shown below.



By taking moments about a suitable point calculate the size of the force that the ladder exerts on the wall and explain in which direction it acts. [5]

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Question taken from Eduqas examination paper 842001, June 2019

Marking Scheme

#1

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*		The point through which the whole of the weight of the object can be considered to act	1			1		
	(b)	(i)	Principle of moments used i.e. 30 $F = 40 \times 150$ (1) $F = 200$ [N] (1)	1	1		2	2	
		(ii)	Moments taken about the front wheel, which is further from the handles (1) $100\ F = 30 \times 150$ (1) $F = 45$ [N] (1)			3	3	3	
		(iii)	Increase the size of the base / distance between the wheels (1) Lower cog of the buggy / increase the weight of the base / lower the centre of gravity (1)	2			2		
			Question 6 total	**4**	**1**	**3**	**8**	**5**	**0**

#2

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(a)	(i)	[lantern moment] $0.9 \times 9.81 \times 0.8$ [= 7.06] [N m] or by implication (1) [bar moment] $1.8 \times 9.81 \times 0.55$ [= 9.70] [N m] or by implication (1) Total = 17 N m **UNIT** (1) accept 16.8 and 16.7 Give 1 mark if g omitted and answer given as 1.7 with or without any unit.	1 1	1		3	3	
		(ii)	[Anticlockwise] torque due to wire = $T \times 1.1$ m $\times \sin 35°$ or by implic (1) $T = 27$ [N] **ecf on (a)(i)** (1)			2	2	2	
		(iii)	Tension must increase (1) Convincing brief explanation e.g. reducing angle decreases [perpendicular] distance **or** reduces component of tension perpendicular to bar (vertical component **or** tension must increase to compensate **or** so that [total] clockwise moment is still balanced (1) **Accept** numerical demonstration using a specific angle smaller than 35° for both marks (First mark for demonstration, second for conclusion)			2	2		
	(b)		1.4 [m s^{-1}]		1		1		
			Question total	**2**	**2**	**4**	**8**	**5**	**0**

#3

Question		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*	It equates [opposing] moments of [weights of] m and M (1) when multiplied each side by g [or equivalent]. (1) 0.150 m is distance of rule's C of G from pivot – could be shown on diagram (1) [Absence of g penalised by 1 only] Or (Derivation of equation using PoM) Distance of C of G from pivot = [0.500 – 0.350] = 0.150 m (1) ACM of mg about the pivot = mgz And CM of Mg about pivot = $Mg \times 0.150$ (1) $\therefore$ By PoM $mgz = Mg \times 0.150$ followed by simplification (1)	1	1 1		3		3
	(b)	Reasonable **best fit** line drawn (1) Gradient 0.0175 [±0.005] [kg m] or equivalent (point chosen on line of best fit) (1) [i.e. 0.017(0) – 0.018(0)] Gradient = $M \times 0.150$ [m] or equivalent used (1) M = 0.117 kg ecf from gradient [0.11 – 0.120]. Answer given to 2 or 3 s.f (1) [Give max of 2 marks for method (1) and answer (1) based on a single *plotted* data point.]			4	4	4	4
	(c)	From graph (or equation) 0.050 kg has to be at about z = 0.34 m. [Accept 0.32 m based on plotted point.] (1) Lower values of m would need larger z, but $z < 0.350$ m so significantly lower values of m not possible (1) or for largest possible value of z (0.35 m), m = 0.049 kg (1) So values of m significantly lower than 0.050 kg not pos. (1)			2	2	1	2
		Question 6 total	**1**	**2**	**6**	**9**	**5**	**9**

#4

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(a)			Diagram showing force and perpendicular distance to pivot clearly labelled (1) Moment = force × perpendicular distance to pivot (1)	2			2		
	(b)	(i)		Distances correct 85 cm and 40 cm (1) Weight = 1.7 [N] / correct use of principle of moments (1) Mass = 0.17 / 0.2 [kg] (1)		3		3	2	3
		(ii)	I	Measure at both ends to ensure same height / spirit level / any suitable method			1	1		1
			II	Application of principle of moments (1) F = 4.26 [N] / accept 4.25 N or 4.3 N (1)		2		2	2	2
	(c)			[Clockwise] moments increase [with larger mass] (1) Mass needs to be moved towards the pivot / newton meter moved away from pivot (1) **Alternative (1)** Raise the clamp holding the newton meter / lower the pivot (1) this is because a greater upward force is needed so the extension of the newton meter spring would be greater (1) **Alternative (2)** Move the pivot towards the centre of mass (1) So this will decrease the moment (1)			2	2		2
				Question total	**2**	**5**	**3**	**10**	**4**	**8**

#5

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		**Calculate the mass of the ruler, *R*** Put known mass on the 0 to 30 cm side of the ruler Adjust the mass until the ruler is level / balances Apply principle of moments to find mass of ruler / accept diagram **Finding unknown mass, *M*** Put unknown mass on 0 - 30 cm side of ruler Put known mass on 30 – 100 cm side Adjust until it balances **Calculating unknown mass, *C*** Apply principle of moments Unknown mass × distance to pivot Equals mass of ruler × 20 + known mass × distance to pivot **5-6 marks** Comprehensive description of how to calculate the mass of the ruler and how to find and calculate the unknown mass. *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.* **3-4 marks** Limited description of how to calculate the mass of the ruler and how to find and calculate the unknown mass OR comprehensive description of how to calculate the mass of the ruler OR comprehensive description of how to find and calculate the unknown mass. *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.* **1-2 marks** Limited description of how to calculate the mass of the ruler OR how to find and calculate the unknown mass. *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure.* **0 marks** No attempt made or no response worthy of credit.	6			6		6
	(b)		All force acts at 90° to wall (1) $R \times 3 \sin 70°$ (1) $= 30 \times 9.8 \times 1.5 \cos 70°$ (1) $R = 53.6$ [N] (1) N3 used to give direction horizontally to the left (1)		1 1 1	1 1	5	3	
			Question 5 total	**6**	**3**	**2**	**11**	**3**	**6**