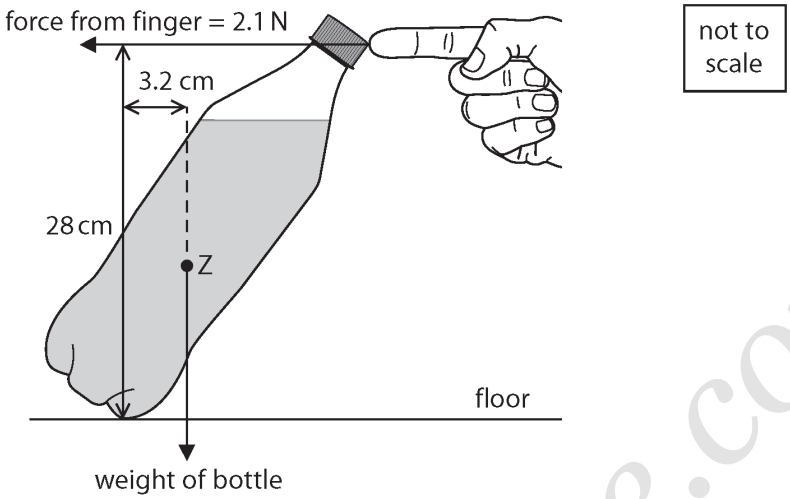
PHYSICS

PAPER 2P, 2PR 2019 - 2023

1 – (4PH1/2P_Summer_2019_Q8) – *Forces And Motion*

The diagram shows a bottle supported by a finger.



(a) State the name of point Z.

(1)

.....

(b) (i) State the formula linking moment, force and perpendicular distance from the pivot.

(1)

(ii) The bottle does not move.

Calculate the weight of the bottle.

(4)

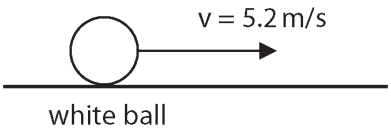
weight of bottle = ... N

(Total for Question 8 = 6 marks)

2 - (4PH1/2PR_Summer_2019_Q7) - *Forces And Motion*

A game is played on a table with balls of different colours.

(a) The diagram shows the white ball moving across a flat surface.



(i) State the formula linking momentum, mass and velocity.

(1)

(ii) The white ball has a mass of 170 g.

Calculate the momentum of the white ball.

(2)

momentum = ... kg m/s

(b) The white ball collides with a stationary black ball.

(i) The black ball has a mass of 160 g.

After the collision, the black ball moves away from the white ball with a velocity of 5.0 m/s.

Calculate the velocity of the white ball after the collision.

(4)

velocity of white ball = ... m/s

(ii) During the collision, the white ball exerts a force of 80 N on the black ball.

The direction of this force is to the right.

State the magnitude and direction of the force the black ball exerts on the white ball during the collision.

(2)

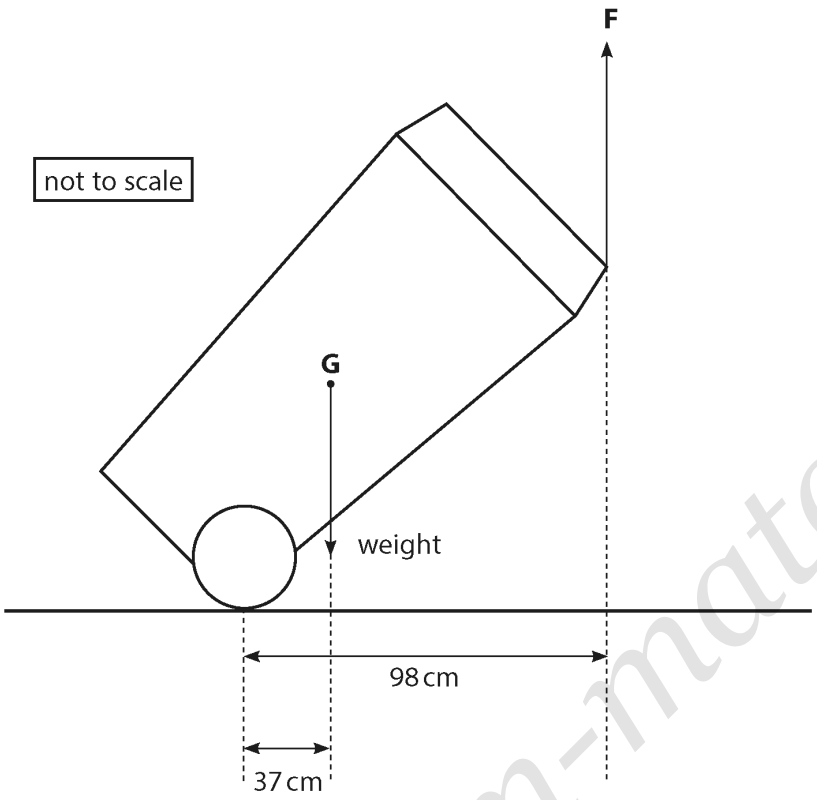
magnitude of force = ... N

direction of force = ...

(Total for Question 7 = 9 marks)

3 – (4PH1/2P_Summer_2020_Q3) – *Forces And Motion*

The diagram shows some of the forces acting on a large rubbish bin on wheels.



(a) The weight of the bin acts through point G.

Give the name of point G.

(1)

.....

(b) The mass of the bin is 23 kg.

(i) What is the weight of the bin?

(1)

- ☒ **A** 23 kg
- ☒ **B** 230 kg
- ☒ **C** 230 N
- ☒ **D** 23 000 N

(ii) State the principle of moments.

(1)

.....

.....

(iii) A person applies force F to the bin to keep it stationary.

Calculate the magnitude of force F.

(4)

magnitude of force F = ... N

(iv) State the magnitude and direction of the force applied to the person by the bin.

(2)

magnitude = ... N

direction = ...

4 – (4PH1/2PR_Summer_2020_Q3) – *Forces And Motion*

A builder needs to lift a large stone block.

(a) Diagram 1 shows the stone block.

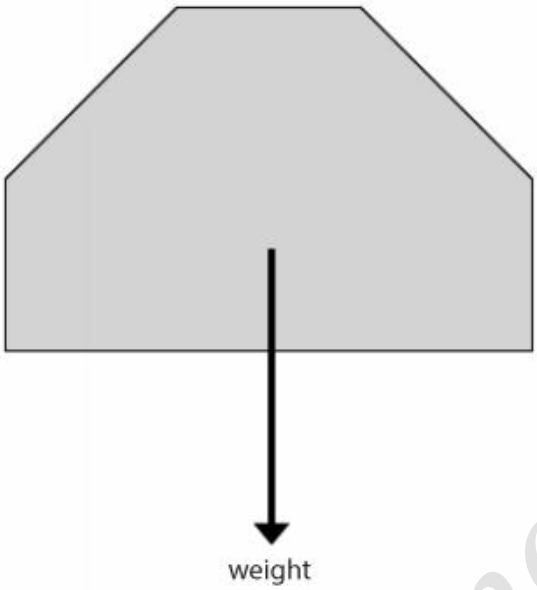


Diagram 1

(i) Draw an X on diagram 1 at the centre of gravity of the stone block.

(1)

(ii) State the formula linking weight, mass and gravitational field strength.

(1)

(iii) The mass of the stone block is 130 kg.

Calculate the weight of the stone block.

(2)

weight = ... N

(b) The builder uses a wooden plank to lift the large stone block.

The plank is uniform and pivoted at its centre.

The builder pushes down on one end of the plank to lift the stone block.

Diagram 2 shows the plank when it is horizontal and stationary.

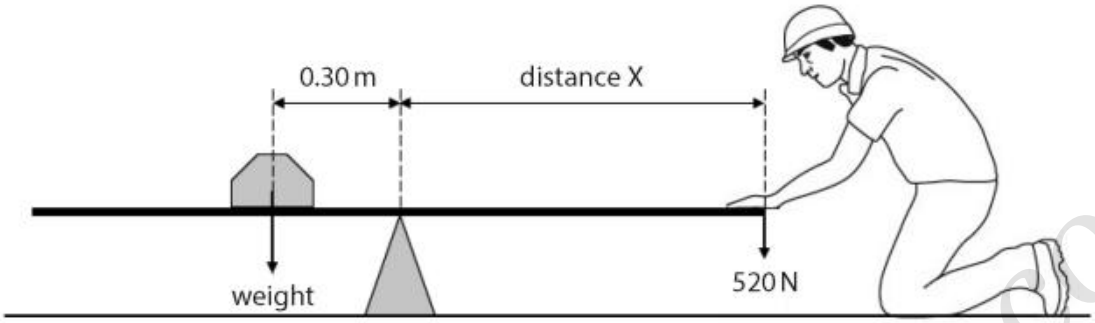


Diagram 2

(i) State the principle of moments.

(2)

.....

.....

.....

.....

(ii) The builder is pushing down with a force of 520 N to keep the plank horizontal.

Calculate distance X.

(3)

distance X = ... m

(iii) Calculate the length of the plank.

(1)

length of plank = ... m

ANSWERS

1 – (4PH1/2P_Summer_2019_Q8) – *Forces And Motion*

(a)		Centre of gravity;	Accept 'Centre of Mass'	1
(b)	(i)	Moment = force x (perpendicular) distance;	Condone M = f x d	1
	(ii)	Any correct moment; i.e. 2.1 x 0.28 or W x 0.032 Evidence of use of principle of moments; i.e. 2.1 x 28 = W x 3.2 Re-arrangement ; i.e. W = 2.1 x 28 /3.2 Evaluation; W = 18 (N)	Allow calculation performed in cm Accept unrounded 18.375, 18.4 N. Condone for 1 mark statement of principle of moments.	4

2 – (4PH1/2PR_Summer_2019_Q7) – *Forces And Motion*

(a)	(i)	momentum = mass × velocity;	allow rearrangements and standard symbols e.g. m = p / v reject m for momentum	1
	(ii)	substitution; evaluation; e.g. (p =) 0.170 × 5.2 (p =) 0.88 (kgm/s)	 -1 if POT error allow 0.884 (kgm/s)	2
(b)	(i)	momentum of black ball calculated; conservation of momentum used correctly; final momentum of white ball calculated; evaluation of final velocity of white ball; e.g. p_{black} = 0.80 (kgm/s) 0.88 = p_{white} + 0.80 p_{white} = 0.08 (kgm/s) v_{white} = 0.47 (m/s)	ignore units stated or implied from calculation allow ecf from (a) ignore units allow 800 (gm/s) allow 80 (gm/s) allow 0.5, 0.4705... 0.49 for use of 0.884 from a(ii)	4
	(ii)	80 (N); (to the) left;		2

3 – (4PH1/2P_Summer_2020_Q3) – *Forces And Motion*

(a)		centre of gravity;	allow centre of mass	1
(b)	(i)	C (230 N); A is not correct as this is the mass of the bin; B is not correct as this has the incorrect unit for force; D is not correct as the mass has been converted to grams before being multiplied by *g*.		1
	(ii)	(in equilibrium) sum of clockwise moments = sum of anticlockwise moments;	condone 'clockwise moment = anticlockwise moment'	1
	(iii)	calculation of moment of weight or expression for moment of F; equating moments; rearrangement for F; correct evaluation of F; e.g. moment of F = 0.98 x F moment of weight = 230 x 0.37 230 x 0.37 = 0.98 x F F = 230 x 0.37 / 0.98 F = 87 (N)	ignore POT for this MP allow 86.8, 86.84, 86.83…	4
	(iv)	Magnitude=candidate's answer for (iii); direction: down(wards);	expect 87 N	2

4 – (4PH1/2PR_Summer_2020_Q3) – *Forces And Motion*

(a)	(i)	X drawn at the base of the weight arrow;	judge by eye	1
	(ii)	weight = mass × gravitational field strength;	allow standard symbols and rearrangements e.g. W = m × *g* ignore 'gravity' for *g*	1
	(iii)	substitution; evaluation; e.g. (W =) 130 × 10 (W =) 1300 (N)	 -1 for POT error only e.g. from incorrectly converting kg to g allow *g* = 9.8, 9.81 allow 1274, 1275.3	2
(b)	(i)	in equilibrium / when balanced; (sum of) clockwise moment(s) = (sum of) anti-clockwise moment(s);	 allow idea that net moment is zero	2
	(ii)	correct expression for either moment; correct use of principle of moments; evaluation of distance X; e.g. 1300 × 0.30 OR 520 × X 1300 × 0.30 = 520 × X X = 0.75 (m)	allow ecf from (a)(iii)	3
	(iii)	(length of plank =) 1.5 (m);	allow ecf from (b)(ii)	1