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EDEXCEL COMBINED SCIENCE PHYSICS: QUESTIONS BY TOPIC

Forces and Their Effects (9)

Combined Science Physics (Higher) Topic 9

3 questions · 29 marks · Mark schemes included

Pearson Edexcel Combined Science (9-1) Physics 1SC0, Higher Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
1. Q2	Paper 2 November 2020	7	4
2. Q4 <i>also Topic 8</i>	Paper 2 June 2018	11	7
3. Q6	Paper 2 November 2020	11	10



QUESTIONS

3 questions · 29 marks · lowest tariff first



7-MARK QUESTIONS

1 question in this booklet



2 (a) Figure 4 shows a drone.



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Figure 4

The drone has four spinning blades.

The upward force produced enables the drone to rise in the air.

The speed at which the blades spin is measured in turns per minute.

Figure 5 shows how the upward force produced by the four blades depends on the speed at which the blades spin.

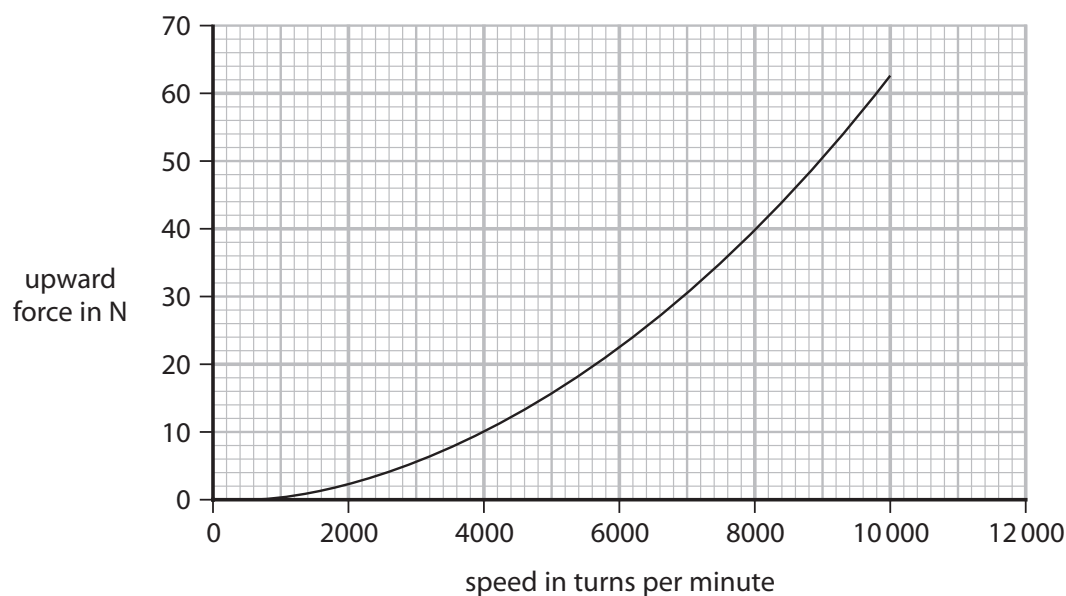


Figure 5

Describe the relationship between upward force and speed shown by this graph.

(2)

.....

.....

.....

.....

(b) A different drone has a mass of 4.5 kg.

This drone rises from the ground to a height of 20 m.

- (i) Calculate the change in gravitational potential energy when the drone rises through a height of 20 m.

The gravitational field strength $g = 10 \text{ N/kg}$.

(2)

change in gravitational potential energy = ... J

- (ii) State the amount of useful work done by the blades as the drone rises through 20 m.

(1)

useful work done = ... J

- (iii) It takes 4 s for the drone to rise through 20 m.

Calculate the useful power developed by the blades in this time of 4 s.

(2)

useful power developed = ... W

(Total for Question 2 = 7 marks)



11-MARK QUESTIONS

2 questions in this booklet



- 4 (a) (i) Figure 5 shows the vertical forces on an aeroplane.

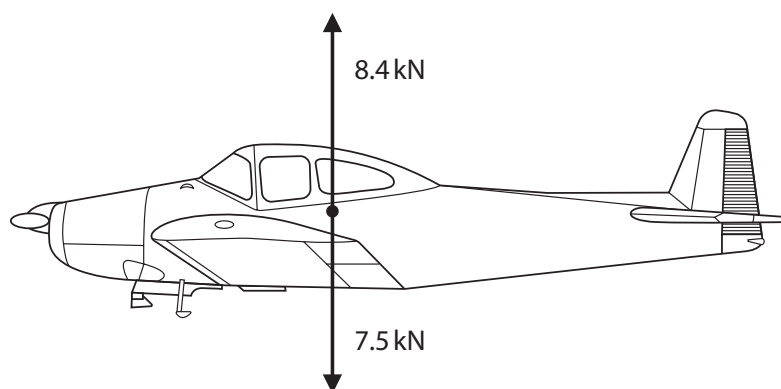


Figure 5

Use information from the diagram to determine the size and direction of the resultant vertical force on the aeroplane.

(2)

size = ... kN, direction is

- (ii) The aeroplane is descending.

Figure 6 shows a diagram of the resultant vertical and horizontal forces on the aeroplane as it is descending.

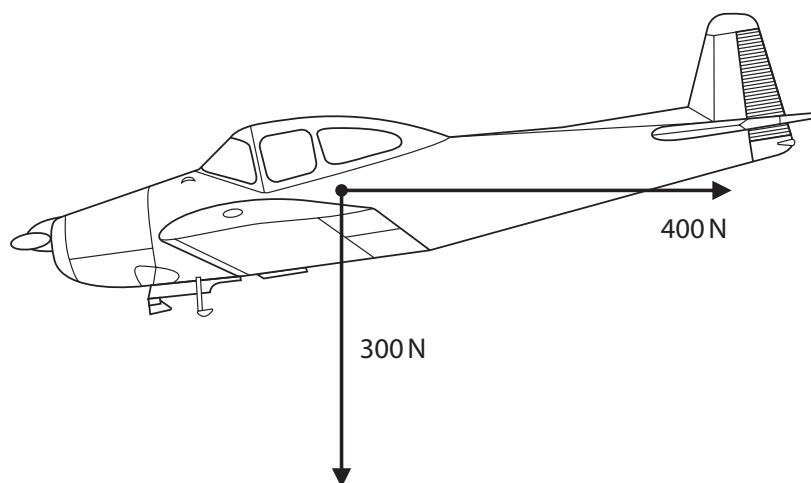


Figure 6

Complete the diagram to show the resultant of these two forces.

(1)

(iii) The mass of the aeroplane is 750 kg.

Calculate the change in gravitational potential energy of the aeroplane as it descends from 1300 m to the ground.

Gravitational field strength (g) = 10 N/kg

(2)

energy = ... J



- (b) The aeroplane is powered by an engine that burns fuel.

The fuel supplies a total of 6500 kJ of energy every minute.

The efficiency of the engine is 0.70 (70%).

- (i) Calculate the power output of the engine.

Give your answer in kW.

(4)

power = ... kW

- (ii) Explain why the efficiency of the engine is less than 1 (100%).

(2)

.....

.....

.....

.....

(Total for Question 4 = 11 marks)



- 6 (a) The magnitude and direction of a force can be represented by a vector.
Figure 13 shows the forces acting on four identical trolleys. The arrows show the magnitude and direction of the forces.

Which diagram shows a pair of forces that will produce zero acceleration?

(1)

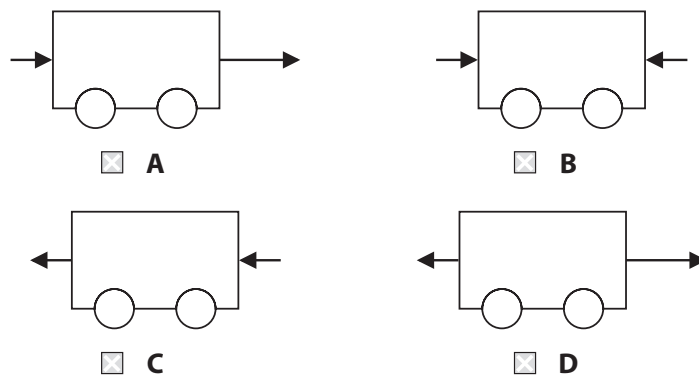


Figure 13

(b) Figure 14 shows two small boats pulling a much larger ship.

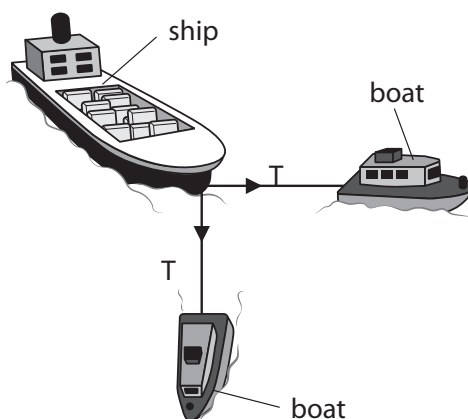


Figure 14

The ship is connected to the boats with ropes.

The tension, T , in each of the ropes has a magnitude of 20 kN.

The ropes are at right angles to each other.

Draw a vector diagram and use it to determine the resultant force that the boats exert on the ship.

(4)

magnitude of resultant force on the ship = ... kN

MARK SCHEMES

official Pearson Edexcel mark schemes



Question number	Answer	Additional guidance	Mark
2 (a)	(upward) force increases with speed (1) relationship is non-linear (1)	allow reverse argument changing rate / increases exponentially / initially no upward force (until 1000 turns per minute)	(2)

Question number	Answer	Additional guidance	Mark
2(bi)	recall and substitution into (1) $\text{gpe} = m \times g \times h$ $(\text{gpe}) = 4.5 \times 10 \times 20$ evaluation (1) 900(J)	allow 90(J) for 1 mark award full marks for the correct answer without working	(2)

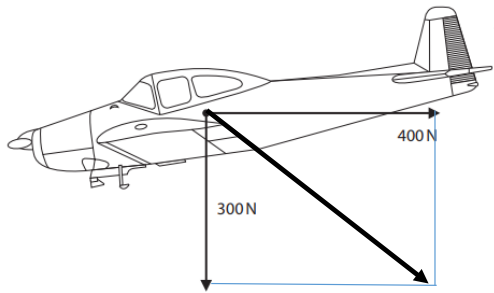
Question number	Answer	Additional guidance	Mark
2bii	900(J)	allow ecf from bi	(1)

Question number	Answer	Additional guidance	Mark
2biii	recall and substitution (1) power = work done / time taken $(\text{power} =) 900 / 4$ evaluation (1) 200 (W)	allow ecf from bi or bii accept 230(W), 225(W) award full marks for the correct answer without working	(2)

Total marks for question 2 = 7



Question Number:	Answer	Additional Guidance	Mark
4(a)(i)	0.9 (k N) (1) up / upwards / ascending (1)	accept .9 or 0.90 north N ↑	(2) AO 3 2a AO 3 2b

Question Number:	Answer	Additional Guidance	Mark
4(a)(ii)		judge length and direction by eye construction lines need not be shown magnitude need not be stated allow missing arrowhead if direction and length are correct reject answers which have any additional vectors drawn	(1) AO 3 2b

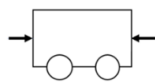
Question Number:	Answer	Additional Guidance	Mark
4(a)(iii)	recall and substitution (1) $GPE = 750 \times 10 \times 1300$ evaluation (1) (energy =) 9 800 000 (J)	no POT error (could have missed out g) allow answers in standard form 9.8×10^6 allow answers that round to 9 800 000 e.g. 9 750 000 J allow 9800 kJ or 9.8MJ allow 9 555 000 J allow negative values award full marks for correct answer without working	(2) AO 2 1

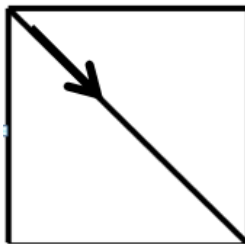
Question Number:	Answer	Additional Guidance	Mark
4(b)(i)	recall efficiency equation (1) $\text{efficiency} = \frac{\text{useful output}}{\text{input}}$ rearrangement (1) output energy = 0.70 x 6500 recall power equation (1) $\text{power} = \frac{\text{energy}}{\text{time}}$ evaluation (1) (power =) 76 (kW)	efficiency = $\frac{\text{power output}}{\text{power input}}$ 4550 (kJ) seen scores 2 marks (from 0.7 x 6500 (kJ)) $\frac{4550}{60}$ accept ecf from output energy accept values that round up to 76 (kW) e.g. 75.8 award full marks for correct answer without working	(4) AO 1 1 AO 2 1

Question Number:	Answer	Additional Guidance	Mark
4(b)(ii)	an explanation linking: (useful) output energy is less than input energy (1) some energy is transferred to less useful forms (1)	input energy is greater than output energy (only) 70% of the input energy is useful energy is dissipated / wasted / lost (to surroundings) energy is lost / transferred as thermal / heat 30% is lost /dissipated / wasted / lost for 2 marks	(2) AO 1 1

(Total for Question 4 = 11 marks)



Question number	Answer	Mark
6(a)	B  A, C and D are incorrect because they all show a resultant force which would cause the trolley to accelerate	(1)

Question number	Answer	Additional guidance	Mark
6(b)	Scale drawing two lines at right angles (1) a correct scaling (for example 10kN equivalent to 1 cm) / a completed square or triangle(1) diagonal in correct direction (1) 28 kN (1)	 judge by eye accept answers from 25kN to 30 kN accept use of Pythagoras award full marks for correct answer without working.	(4)

Question number	Indicative content	Mark
6c*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive, and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. A01 Horizontal forces • tension in the string/pull of the string • tension is one of the horizontal forces acting on the wooden block • friction between the table and the wooden block • friction acts in the opposite direction to the tension • friction opposes motion • the force due to friction is equal to the force provided by the tension • the forces are balanced /equal and opposite • no resultant force, so the block moves at a constant (horizontal) velocity Vertical forces • (normal) reaction (force) upwards between the table and the wooden block • contact force • weight of block downwards • the weight (force of gravity) and the (normal) reaction are equal and opposite / balanced • the block does not move up or down • tension caused by the force due to gravity on the weight • vertical forces on the block do not affect horizontal velocity. labels on the diagram should be considered when marking candidates do not have to indicate the forces as horizontal and vertical	(6)



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) - Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	- Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) - Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	- Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) - Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> Elements of physics present i.e. isolated knowledge of principles two unconnected statements from any section	<u>Possible candidate responses</u> contact force weight pulls block friction tension in string weight acts downward reaction
Level 2	3–4	<u>Additional guidance</u> Some knowledge of principles with a logical connection made in one section and statement from the other section OR Detailed knowledge of principles with logical connections made in one section	<u>Possible candidate responses</u> There is friction between the table and the block and this opposes motion weight of block acts downwards
Level 3	5–6	<u>Additional guidance</u> Detailed knowledge of principles with logical connections made in one section and statement from the other section	<u>Possible candidate responses</u> Friction and tension are equal and opposite there is no resultant /no acceleration The weight (of the block) and the(normal) reaction are equal and opposite

Total marks for question 6 = 11

