

9 A car accelerates at a constant rate of 1.83 m/s^2 along a flat straight road.

(a) The force acting on the car is 1.870 kN .

Calculate the mass of the car.

Give your answer to three significant figures.

(3)

mass = kg

(b) The car accelerates from rest for 16 s .

Calculate the speed of the car after 16 s .

(3)

speed = m/s

*(c) Figure 12 is a speed-time graph for a different car moving on a horizontal road.

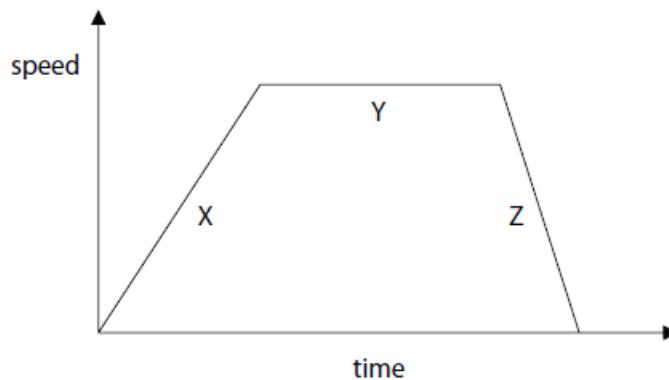


Figure 12

Describe the energy transfers taking place during the movement of the car.

You should refer to energy stores as well as transfers between energy stores for all three sections of the graph.

(6)

(Total for Question 9 = 12 marks)

Question number	Answer	Additional guidance	Mark
9(a)	<p>rearrangement (1)</p> $m = \frac{f}{a}$ <p>substitution and conversion (1)</p> $m = \frac{1870}{1.83}$ <p>answer and rounding to 3 s.f. (1) 1020 (kg)</p>	<p>maximum 2 marks if kN not converted to N</p> <p>award full marks for correct numerical answer without working</p>	(3)

Question number	Answer	Additional guidance	Mark
9(b)	<p>rearrangement of $\frac{(v-u)}{t} = a$ (1)</p> $v = u + at$ <p>substitution (1)</p> $v = 0 + 1.83 \times 16$ <p>answer (1) 29.3 (m/s)</p>	<p>award full marks for correct numerical answer without working</p>	(3)

Question number	Indicative content	Mark
*9(c)	<p>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.</p> <p>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.</p> <p>AO2</p> <ul style="list-style-type: none"> • fuel forms a store of chemical (potential) energy • chemical energy is transferred to kinetic energy and thermal energy when the car moves • kinetic energy transferred to thermal energy as the car slows down <p>AO3</p> <ul style="list-style-type: none"> • during X, kinetic energy increases as the car's speed increases/car accelerates and the increase in kinetic energy is provided by the chemical energy store • during all three sections, work is done against frictional forces in the moving parts of the car and against the drag from the air • during Y, kinetic energy stays constant when the car moves at constant speed but energy is still transferred to thermal energy • during Z, kinetic energy decreases as the car slows down 	(6)

Level	Mark	Descriptor
	0	No awardable content.
1	1–2	<ul style="list-style-type: none"> • Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The description attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
2	3–4	<ul style="list-style-type: none"> • Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • The description is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)

3	5–6	<ul style="list-style-type: none"> • Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The description is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)
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