Assessment Schedule – 2019

Science: Demonstrate understanding of aspects of mechanics (90940)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	In Section A, the boat speeds up / accelerates for 400 s. In Section B it has a constant speed of 3 m s^{-1} for 300 s. In Section C it slows down / decelerating for 100 s.	• Two correctly described sections.	.	
(b)	$a = \frac{\Delta v}{\Delta t} = \frac{3.0}{400} = 7.5 \times 10^{-3}$ m s^{-2} OR 0.0075 m s^{-2} OR 7.5E-3	• Correct answer. (do not accept fraction).		
(c)	Thrust and friction / drag are equal and opposite. The boat is moving with a constant speed, meaning that the acceleration is zero. If acceleration is zero, the net force must also be zero. This means that all the forces acting are balanced. Forces are balanced and thus $F_{net} = 0$ and therefore there is no acceleration (in Section B)	• All the forces are balanced / net force = 0. • Acceleration in Section B is zero. • Thrust and drag are equal.	• Balanced forces / 0 net force resulted in constant speed in this case . • Horizontal forces are balanced as they are equal and opposite. • FN = 0 therefore no acceleration.	• Shows an understanding of how the $\boldsymbol{F_{net} = 0}$ is connected with the constant speed (forward)AND therefore no acceleration in Section B of the graph.
(d)	Distance travelled = area under the graph. (SHOW QUESTION) $d = (0 - 400\text{ s}) = \frac{1}{2} \times 400 \times 3 = 600$ m $d = (400 - 700\text{ s}) = 300 \times 3 = 900$ m $d = (700 - 800\text{ s}) = \frac{1}{2} \times 100 \times 3 = 150$ m Total distance = 600 + 900 + 150 = 1650 m Or Trapezium method.	• Calculation of an area of the graph (statement or attempt to calculate the area made).	• Correct method with mistake in one section.	• Correct working.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	TWO Merit points.	THREE Merit points.	TWO Excellence points (missed out forward in (c)).	TWO Excellence points.

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	The adult has a weight force that is acting down on the sand through their feet. Pressure is created as the adult's weight is spread over the surface area of their feet.	• Weight (Force is acting down) through the adult's feet. OR Weight is spread across area of feet		
(b)	Adult: (SHOW QUESTION) $A = 0.020 \times 2 = 0.040\ \text{m}^2$ $P = \frac{F}{A} = \frac{690}{0.04} = 17\,250\ \text{Pa}$	• Calculates pressure of adult using incorrect area.	• Calculates pressure of adult using correct area. (Could divide by 2 at the end)	
(c)	Pressure equals the force exerted divided by the surface (contact) area, The child has the same pressure as the adult because they sink an equal distance into the soft sand. However, the child has a smaller surface (contact) area on the sand, and thus must exert a smaller force for the pressure to remain the same. The smaller force is the gravitational force, which means that the mass of the child must be smaller as $F_g = mg$.	• States force / mass must be smaller OR area smaller OR pressure is the same.	• States pressure is the same, thus mass / force must be smaller OR states pressure is the same, thus area of child's foot smaller.	• Comprehensively links smaller force and smaller area creates identical pressure and depth. OR Linking $P = \frac{F}{A}$ with Force is less ,Area is less so therefore, Pressure stays the same.
(d)	Child: $A = 0.015 \times 2 = 0.030\ \text{m}^2$ $F = PA = 17\,250 \times 0.03 = 517.5\ \text{N}$ $m = \frac{F}{g} = \frac{517.5}{10} = 51.8\ \text{kg}$	• Calculates force of the child using incorrect are (ONE correct equation).	• Calculates force of child using correct area. (TWO correct equations).	• Correct working.(all THREE equations are correct).
(e)	$W = Fd$ $d = \frac{W}{F} = \frac{21}{690} = 0.0304\ \text{m}$	• Calculates distance using incorrect weight force.	• Calculates the distance correctly.	

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	TWO Merit points.	THREE Merit points.	TWO Excellence points; Missing unit for mass	TWO Excellence points.

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	$E_P = mgh = 63 \times 10 \times 3500 = 2\ 205\ 000$ J (SHOW QUESTION)	• Calculation with error.	• Correct working.	
(b)	$v = \frac{d}{\Delta t} = \frac{450}{9.49} = 47.4$ m s^{-1}	• Calculates speed.		
(c)	The forces acting on the parachutist are the weight downwards and air resistance upwards. The forces are unbalanced because the weight force is greater than air resistance. Thus the net force is in the direction of the weight force downwards. The net force downwards makes the parachutist accelerate in the direction downwards.	• Identifies two named forces. • Describes net force. • States forces are unbalanced. • Motion is acceleration.	• Describes two forces (weight / gravity and air resistance) and weight is greater than air resistance. • Explains that unbalanced forces / an F_{net} greater than zero lead to an acceleration.	• Weight/gravity force is greater than air resistance/drag. Thus the net force is (in the direction of the weight force) downwards. The net force downwards makes the parachutist accelerate in the direction downwards.
(d)	$\Delta E_P = E_K$ $E_K = 283\,500$ $E_K = \frac{1}{2}mv^2$ $283\,500 = \frac{1}{2} \times 63 \times v^2$ $v^2 = 2 \times \frac{283\,500}{63}$ $v = \sqrt{9000} = 94.9$ m s^{-1} = 95 m s^{-1} (2 sig.fig.)	• $\Delta E_P = E_K$ • Selects correct equation for kinetic energy.	• Correct methods and working but wrong answer for speed due to minor error. (E.g. forgetting to take square root of answer.)	• Correct answer with correct methods and working. *Correct sig. fig. not required.* Or $a = \frac{v}{t}$, therefore $v = a \times t$ $= 9.49 \times 10 = 94.9$ m s^{-1}

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	TWO Merit points.	THREE Merit points.	TWO Excellence points Unit speed	TWO Excellence points.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 18	19 – 24