Assessment Schedule – 2006

Physics: Demonstrate understanding of mechanics in one dimension (90183)

Evidence Statement

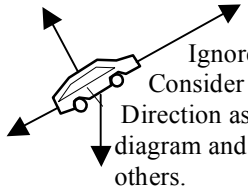
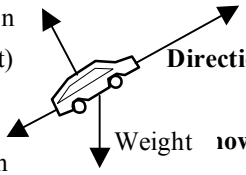
Note: Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging.
- the power of any number that is multiplied by a power of 10 is correct.

Correct units and significant figures are required only in the questions that specifically ask for them.

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
1(a)	20 s Accept without unit or incorrect unit.	[1] Correct answer.		
1(b)	150 m	[2] Correct answer.		
1(c)	Moving at a (constant) acceleration at first then moving at a constant velocity/speed.	[1] Correct answer. (Uses description in answer not calculated values.)		
1(d)	$v = \frac{d}{t} = \frac{600}{22} = 27.3\text{ m s}^{-1} / 27\text{ m s}^{-1}$	[2] Correct working and answer.		
1(e)	$v = \frac{d}{t} = \frac{600-500}{20-15} = \frac{100}{5} = 20\text{ m s}^{-1}$ Accept 100 / 5 =20 m s^{-1} on its own.	[2] Correct working.		
1(f)	$E_k = ½\ m \times v^2$ $= ½ \times 1350 \times 20^2$ $= 270\,000$ J / $(2.7 \times 10^5$ J) = 270 kJ	[2] Correct working and answer in joules.	[2] Correct working and answer in kilojoules.	
1(g)	Unbalanced force is zero. The car is moving at a constant speed so its acceleration is zero.	[1] Mentions unbalanced force is zero. (Accept net / resultant.)	[1] Correct answers.	
2(a)	(Constant) acceleration / increasing velocity.	[1] Correct answer.		
2(b)	Grad. of the line = $\frac{30-10}{5.0} = 4.0\text{ m s}^{-2}$ $F = ma = 1350 \times 4.0$ = 5400 N / 5.4×10^3 N	[2] Correct working and answer for acceleration.	[2] Correct working and answer for $F = ma$	
2(c)	Area under the graph $= (5 \times 10) + (0.5 \times 5 \times 20)$ = 100 m	[2] Has working fully correct but answer is wrong.	[2] Correct working and answer.	
2(d)	$\Delta t = \frac{\Delta v}{a} = \frac{30}{8} = 3.75$ s / 3.8 / 4.0 accept	[2] Correct working and answer.		

2(e)	$E_k = ½\ m \times v^2$ $= ½ \times 1350 \times 30^2$ $= 607\ 500$ J $F \times d = 607\ 500$ $d = \frac{607\ 500}{10\ 800} = 56.25$ m / 56 / 56.8 m	[2] Correct working and answer for E_k. (Accept $\frac{30 \times 3.75}{2} = 56.25$ m)	[2] Correct methods and working, showing relationship between E_k and W but answer is incorrect. (Accept extrapolation if shown clearly on graph.)	[2] Correct working and answer for E_k and W.
2(f)	Pressure on the small piston $\frac{F}{A} = \frac{110}{0.0007} = 157\ 142.6$ Pa Force on the large piston $= P \times A = 157\ 142.6 \times 0.0037$ = 581.4 N / 581 / 580	[2] Correct working and answer for 157 142.7 Pa. (Make sure its for the small piston.)	[2] Correct working and answer. (For the pressure (small piston) and force (large piston).)	
2(g)	Force = Pressure × Area. Since the pressure is the same at both pistons, the piston with a larger area exerts a greater force. So a small force at the small piston is magnified into a large force at the large piston.		[1] Explains that Force = Pressure × Area The piston with a larger area exerts a greater force.	[1] Correct and clear explanation as is in evidence
3(a)	$E_p = mgh = 1350 \times 10 \times 20 = 270\ 000$ J $(2.7 \times 10^5$ J) (270 kJ)	[2] Correct working and answer.		
3(b)	The force due to gravity causes uniform acceleration (of 10 m s^{-2}). So the vertical velocity is increasing (at a constant rate).	[1] Mentions the force due to gravity causes uniform acceleration (of 10 ms^{-2}).	[1] Correct and clear explanations using both statements.	
3(c)	$E_p = mgh = 1270 \times 10 \times 20 = 254\ 000$ J $E_k = ½\ m \times v^2 = 254\ 000$ J $½ \times 1270 \times v^2 = 254\ 000$ J $v^2 = \frac{2 \times 254\ 000}{1270}$ $= \sqrt{400}$ $v = 20$ m s^{-1}		[2] Correct methods and working for E_p and E_k but wrong answer. Accept $E_p = mgh$ $E_k = mv^2 / 2$ $E_p = E_k$ $mgh = mv^2 / 2$ $v = \sqrt{2gh}$ $= \sqrt{400}$ $v = 20$ ms^{-1}	[2] Correct working and answer for E_p and E_k.
3(d)	The velocity is smaller because: - when the car hits the water, part of its energy is transformed into kinetic energy of the water, heat and sound. - Heat occurs because of friction force - Sound due to splashing of water - a part of the energy is used to overcome the friction force of the water.	[1] Mentions velocity is smaller and identifies Kinetic energy / sound / heat / buoyancy.	[1] Mentions velocity is smaller and gives a reason.	[1] Mentions velocity is smaller and gives two reasons.

4(a)	Work is done when a force causes motion in the direction of the force. Here the force is not causing the movement of the car, so no work is being done. • No work is done because the car has not moved up in the direction of the force and it has gained no gravitational potential energy.		[1] Correct explanation. W = F × d plus one of the reasons.	.
4(b)	$d = v \times t = 0.30 \times 80 = 24$ m $W = F \times d$ $= 16\,000 \times 24$ $= 384\,000$ J $P = \frac{E}{t} = \frac{384\,000}{80} = 4\,800$ W		[2] Correct methods and answers for distance and work, but wrong answer for power.	[2] Correct working and answers for distance, work and power.
Unit	Watt / W / kW	[1] Correct unit.		
4(c)	(1) Work is done when a **force** acts along the direction of motion. (back &forth movement in a horizontal direction). (2) Here the pulling **force** is upwards while direction of motion of the swing is at right angles to pulling force, so no work is done.		[1] Shows an understanding of statement 1 or 2.	[1] Correct and clear explanation of both statements.
4(d)	 Ignore magnitude, Consider direction only. Direction as shown on diagram and accept no others.	[1] Correct direction for **any three** forces.	[1] Correct direction for **all forces.**	
4(e)	 Tension/ Pull Reaction (support) **Direction of forces** Weight Friction **own and a** **others.**	[1] Labels correctly any **three** forces. (Forces must be in the correct direction.)	[1] Correct labelling of **all** forces.	
Total opportunities		**criterion 1: 9** **criterion 2: 10**	**criterion 1: 8** **criterion 2: 7**	**criterion 1: 3** **criterion 2: 3**

Judgement Statement

Physics: Demonstrate understanding of mechanics in one dimension (90183)

The grade awarded is the highest one that has been demonstrated in all achievement criteria up to and including that grade.

The following is a guide to the standard required for each grade in the two criteria.

Criterion One

Achievement	Achievement with Merit	Achievement with Excellence
Total of FIVE opportunities answered at Achievement level or higher. 5 × A1	Total of SIX opportunities answered with THREE at Merit level or higher. 3 × M1 + 3 × A1	Total of SEVEN or EIGHT opportunities answered with at least ONE or TWO at Excellence level and THREE at Merit level. 1 *or* 2 × E1 + 3 × M1 + 3 × A1 (Note: A total of 3 × E with at least ONE from each criterion.)

Criterion Two

Achievement	Achievement with Merit	Achievement with Excellence
Total of SIX opportunities answered at Achievement level or higher. 6 × A2	Total of SIX opportunities answered with THREE at Merit level or higher. 3 × M2 + 3 × A2	Total of SEVEN or EIGHT opportunities answered with at least TWO at Excellence level and THREE at Merit level. 1 *or* 2 × E2 + 3 × M2 + 3 × A2 (Note: A total of 3 × E with at least ONE from each criterion.)

Overall Judgement Statement

Note: For Excellence overall a total of THREE opportunities answered at Excellence level is required, with at least ONE from each of Criterion One and Two.

Achievement Criteria			
Achievement	**Achievement with Merit**	**Achievement with Excellence**	
5 × A1	3 × M1 + 3 × A1	3 × M1 + 3 × A1	3 × E with at least ONE from each criterion.
6 × A2	3 × M2 + 3 × A2	3 × M2 + 3 × A2	