GradeMax

Pearson

Mark Scheme (Final)

January 2026

International Advanced Level in Mechanics M1

WME01/01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

EDEXCEL IAL MATHEMATICS
General Instructions for Marking

1. The total number of marks for the paper is 75.

2. The Edexcel Mathematics mark schemes use the following types of marks:
   - **M** marks: Method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
   - **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
   - **B** marks are unconditional accuracy marks (independent of M marks)

   Marks should not be subdivided.

3. Abbreviations

   These are some of the traditional marking abbreviations that will appear in the mark schemes and can be used if you are using the annotation facility on ePEN:

   - bod – benefit of doubt
   - ft – follow through
     - the symbol $\surd$ will be used for correct ft
   - cao – correct answer only
   - cso – correct solution only. There must be no errors in this part of the question to obtain this mark
   - isw – ignore subsequent working
   - awrt – answers which round to
   - SC – special case
   - oe – or equivalent (and appropriate)
   - d… or dep – dependent
   - indep – independent
   - dp – decimal places

- sf – significant figures
- * – The answer is printed on the paper or ag- answer given
- ⌐ or d… – The second mark is dependent on gaining the first mark

4. All A marks are 'correct answer only' (cao), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft, but manifestly absurd answers should never be awarded A marks.

5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected. If you are using the annotation facility on ePEN, indicate this action by 'MR' in the body of the script.

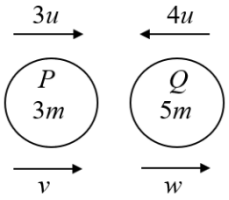
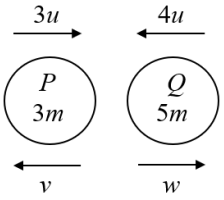
6. If a candidate makes more than one attempt at any question:
   a) If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
   b) If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

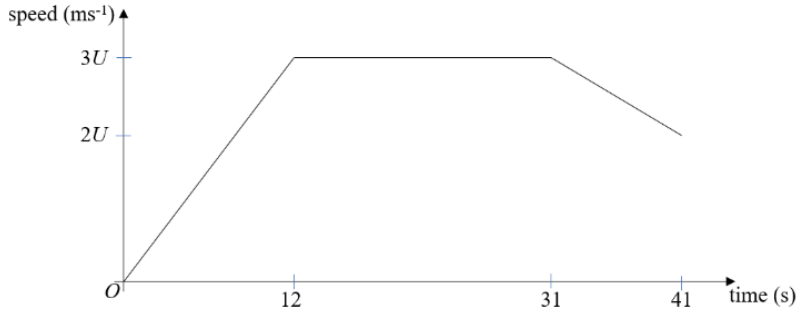
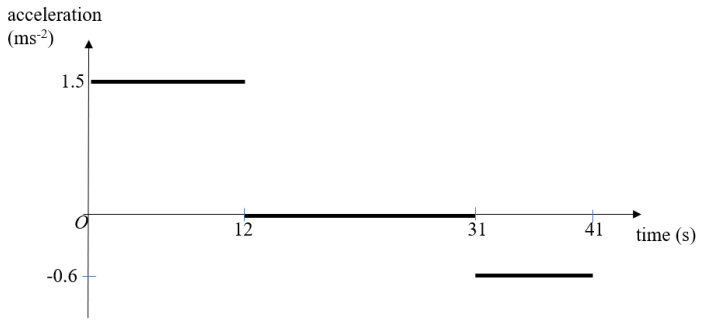
7. Ignore wrong working or incorrect statements following a correct answer.

General Principles for Mechanics Marking

(***N.B.*** *specific mark schemes may sometimes override these general principles*)

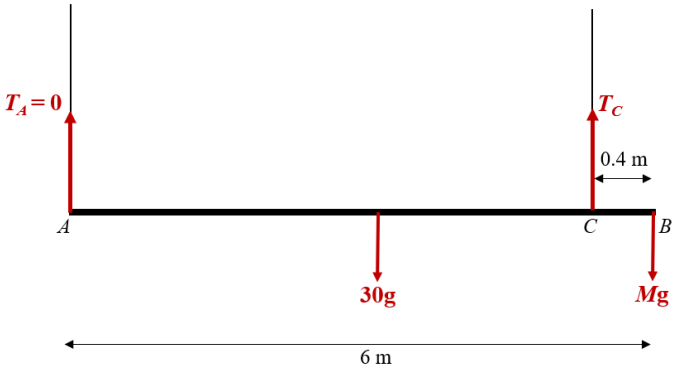
- Rules for M marks:
  - correct number of terms
  - dimensionally correct
  - all terms that need resolving (i.e. *multiplied* by cos or sin) are resolved
  - only terms that need resolving are resolved
  - +/– errors are condoned
  - sin/cos confusion is condoned
- Omission or extra *g* in a resolution is an accuracy error not method error.
- Omission of mass from a resolution is a method error.
- Omission of a length from a moments equation is a method error.
- Omission of units or incorrect units is not (usually) counted as an accuracy error.
- DM indicates a dependent method mark, i.e. one that can only be awarded if a previous specified method mark(s) has been awarded.
- Any numerical answer which comes from use of $g = 9.8$ should be given as a decimal to 2 or 3 SF.
- Use of $g = 9.81$ should be penalised once per (complete) question.
  - N.B. Over-accuracy or under-accuracy of correct answers should only be penalised *once* per complete question. However, premature approximation should be penalised every time it occurs.
- Marks must be entered in the same order as they appear on the mark scheme.
- In all cases, if the candidate clearly labels their working under a particular part of a question i.e. (a) or (b) or (c)…then that working can only score marks for that part of the question.
- Accept column vectors in all cases.
- Misreads – if a misread does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, bearing in mind that after a misread, the subsequent A marks affected are treated as A ft

Question Number	Scheme		Marks
1			
(i)	Impulse equation for P		M1
	$-\frac{33}{2}mu = 3m(v-3u)$	$-\frac{33}{2}mu = 3m(-v-3u)$	A1
	Speed of $P = \frac{5}{2}u$		A1
(ii)	Impulse equation for Q or CLM		M1
	Impulse: $\frac{33}{2}mu = 5m(w--4u)$ or CLM: $3m(3u)+5m(-4u) = 3m\left(-\frac{5}{2}u\right)+5mw$		A1
	Speed of $Q = \frac{7}{10}u$		A1
			(6)
	Notes for Question 1		
	Allow parts (i) and (ii) to be answered in either order.		
1(i)			
M1	Relevant equation to find the speed of P. Impulse-momentum equation using $\frac{33}{2}mu$, $3m$ and $3u$. Dimensionally correct, correct no. of terms, condone sign errors. If speed of Q is found first, may use CLM with their velocity of Q and correct mass-velocity pairs. M0 if g is used in Impulse equation but condone consistent g in CLM.		
A1	Correct equation for P. If speed of Q is found first, CLM equation is: $3m(3u)+5m(-4u) = 3m(\pm v)+5m\left(-\frac{7}{10}u\right)$		
A1	Correct speed of P, must be positive.		
1(ii)			
M1	Relevant equation to find the speed of Q. Impulse-momentum equation using $\frac{33}{2}mu$, $5m$ and 4u or CLM with v replaced and mass-velocity paired correctly. Dimensionally correct, correct no. of terms, condone sign errors. M0 if g is used in Impulse equation but condone consistent g in CLM.		
A1	Correct unsimplified equation. CLM note: there is no follow through for incorrect velocity of P		
A1	Correct speed of Q, must be positive.		

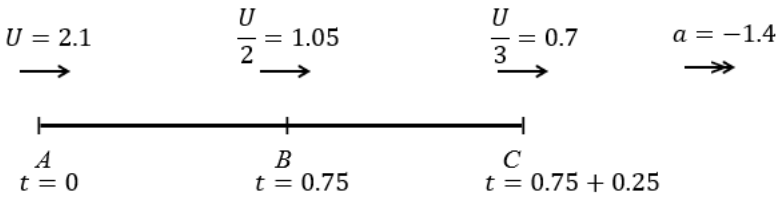
Question Number	Scheme	Marks
2		
(a)	Method to find U	M1
	$600=\frac{12\times 3U}{2}+(19\times 3U)+\left(\frac{3U+2U}{2}\right)10$	A1
	$U=6$ *	A1*
		(3)
(b)	Method to find required distance: $\frac{4\times 6}{2}$	M1
	12 (m)	A1
		(2)
(c)	$1.5\left(\text{ms}^{-2}\right)$	B1
		(1)
(d)	Method to find deceleration, $\pm\frac{6}{10}$	M1
	$0.6\left(\text{ms}^{-2}\right)$	A1
		(2)
(e)		B1 (shape) B1ft (vertical labels)
		(2)
		(10)
	Notes for Question 2	
2(a)		
M1	Complete method using distance of 600 to form an equation in U only. Correct structure of areas. Accept verification approach (i.e. numerical areas sum to 600)	
A1	Correct unsimplified equation.	

A1*	Obtain given answer from complete and correct working. Must be at least one line of working in addition to an equation and the given answer. Must reach "$U = 6$" or "$6 = U$". If using verification, must conclude $U = 6$.	
2(b)		
M1	Complete method to find the distance travelled in the first 4 seconds. May find acceleration and use *suvat*. Eg • $18 = 0 + 12a \quad (\Rightarrow a = 1.5)$ then $6^2 = 0^2 + 2"a"s$ • Area in 12s is 108m, $SF = \frac{1}{9} \Rightarrow Dist = "108" \div 9$	
A1	Correct answer.	
2(c)		
B1	Correct answer.	
2(d)		
M1	Correct method to find the deceleration.	
A1	Correct answer, must be positive.	
2(e)		
B1	Correct shape of acceleration-time graph. Three solid horizontal lines correctly positioned relative to an axis representing positive, negative and zero acceleration. BOD if section $12,, t,, 31$ is difficult to see. B0 if there is a solid vertical line.	
B1ft	Both values present on the vertical axis. Follow through their constant acceleration but must have one above the time axis and one below the time axis (representing a positive and negative acceleration). However, B0 if any graph sections are not horizontal.	

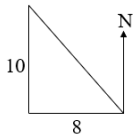
Question Number	Scheme	Marks
3		
(a)	$(2p\mathbf{i}-3p\mathbf{j})+(q\mathbf{i}+\mathbf{j})+(3\mathbf{i}-q\mathbf{j})=(2p+q+3)\mathbf{i}+(-3p+1-q)\mathbf{j}$	M1
	Correct method using the direction vector $4\mathbf{i}-5\mathbf{j}$ to form an equation in p and q only	M1
	$\dfrac{2p+q+3}{-3p+1-q}=\dfrac{4}{-5}$	A1
	Working that leads to $2p-q=19$ *	A1 *
		(4)
(b)	$q=-5$	B1
	N2L in vector form	M1
	$(14-5+3)\mathbf{i}+(-21+1+5)\mathbf{j}=0.5\mathbf{a}$	A1
	$\mathbf{a}=(24\mathbf{i}-30\mathbf{j})\quad\left(\text{ms}^{-2}\right)$	A1
		(4)
		(8)
	Notes for Question 3 **Accept column vectors throughout**	
3(a)		
M1	Find the sum of the three forces and collect **i**'s and **j**'s	
M1	Use the direction vector $4\mathbf{i}-5\mathbf{j}$ correctly with their **i** and **j** components to form an equation in p and q only. Accept equivalent forms. May use $(2p+q+3)\mathbf{i}+(-3p+1-q)\mathbf{j}=\lambda(4\mathbf{i}-5\mathbf{j})$ and equate components to form an equation in p and q. M0 if equation is formed from simultaneous equations.	
A1	Correct unsimplified equation in p and q	
A1*	Obtain the given answer from complete and correct working. Must see at least one line of working between the initial equation in p and q and the given answer. Accept $19=2p-q$	
3(b)		
B1	Correct value for q	
M1	Use of $\mathbf{F}=m\mathbf{a}$ (vector form) with $p=7$ and their q substituted. Must use the resultant force (vector sum of $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$) correctly with $m\mathbf{a}$. M0 for using $\lvert\mathbf{F}\rvert=m\lvert\mathbf{a}\rvert$. M0 if weight is included as a force.	
A1	Correct unsimplified vector equation	
A1	Correct acceleration vector. ISW if Pythagoras is used to find $\lvert\mathbf{a}\rvert$ *after* finding acceleration vector.	

Question Number	Scheme	Marks
4 **(a)**		
	First relevant equation in T_A and/or T_C	M1
	Correct unsimplified equation Relevant equations: • M(B) $(T_A \times 6)+(T_C \times 0.4)=(30g \times 3)$ • M(A) $(T_C \times 5.6)=(30g \times 3)+(20g \times 6)$ • M(C) $(T_A \times 5.6)+(20g \times 0.4)=(30g \times 2.6)$ • M(G) $(T_A \times 3)+(20g \times 3)=(T_C \times 2.6)$ • Vert $T_A + T_C = 20g + 30g$	A1
	Second equation in T_A and/or T_C	M1
	Correct unsimplified equation	A1
	$T_C = 368$ or 370 (N)	A1
	$T_A = 123$ or 120 (N)	A1
		(6)
(b)		
	Form an equation in M only	M1
	M(C): $(Mg \times 0.4)=(30g \times 2.6)$	A1
	$M = 195$	A1
		(3)
		(9)
	Notes for Question 4	

	Mark parts (i) and (ii) together if required. Penalise use of $g = 9.81$ on first occasion only. Penalise over/under accuracy of final answer on first occasion only.	
4(a)	If more than two equations seen, mark the two that are used in the order they appear.	
M1	First relevant equation in T_C and/or T_A . Correct number of terms. Dimensionally correct (force × length in a moments equation).	
A1	Correct unsimplified equation	
M1	Form a second relevant equation in T_C and/or T_A. Correct number of terms. Dimensionally correct (force × length in a moments equation). Condone re-using T in M(A) and M(C) as long as clearly separate tensions.	
A1	Correct unsimplified equation	
A1	Correct answer for tension in C, 2/3sf. Accept $\frac{75}{2}g$, $37.5g$ ISW	
A1	Correct answer for tension in A, 2/3sf. Accept $\frac{25}{2}g$, $12.5g$ ISW	
4(b)		
M1	Uses moments to form an equation in M only. Correct terms included and dimensionally correct. May use two equations and eliminate T_C. Vert : $T_C = 30g + Mg$ M(A) : $(T_C \times 5.6) = (30g \times 3) + (Mg \times 6)$ M(G) : $(T_C \times 2.6) = (Mg \times 3)$ M(B) : $(T_C \times 0.4) = (30g \times 3)$ M0 if tension at A is never 0. M0 if a tension from part (a) is used.	
A1	Correct unsimplified equation in M only	
A1	Correct answer only.	

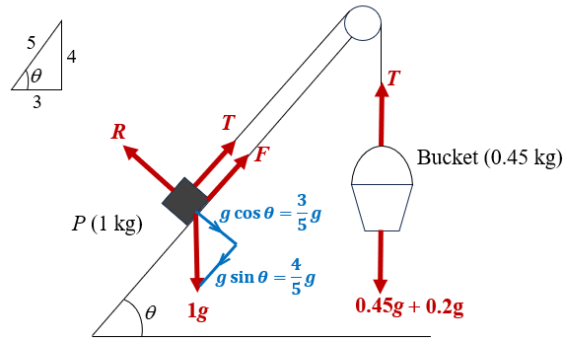
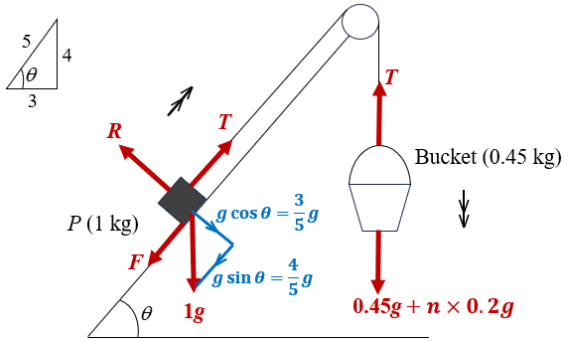
Question Number	Scheme	Marks
5		
(a)	Vert $R = mg$	B1
	$F = \frac{1}{7}R$	B1
	N2L $-F = ma$	M1
	$a = \pm\frac{g}{7}$ or ± 1.4	A1
	suvat from A to B $\frac{U}{2} = U + a(0.75)$	M1
	Obtain given answer $U = 2.1$ *	A1*
		(6)
(b)	*suvat* from B to C	M1
	For example, • $\frac{2.1}{3} = \frac{2.1}{2} + \left(\frac{-g}{7}\right)t$ • $\frac{U - \frac{U}{2}}{0.75} = \frac{\frac{U}{2} - \frac{U}{3}}{t}$	A1
	$t = 0.25$ (s)	A1
		(3)
(c)	*suvat* from A to C	M1
	For example, • $s = \left(\frac{2.1 + \frac{2.1}{3}}{2}\right)(0.75 + "0.25")$ • $\left(\frac{2.1}{3}\right)^2 = 2.1^2 + 2\left(-\frac{g}{7}\right)s$	A1ft
	1.4 (m)	A1
		(3)
		(12)
	Notes for Question 5	
	Penalise use of $g = 9.81$ on first occasion only. Penalise over/under accuracy of final answer on first occasion only.	
5(a)		
B1	Vertical equilibrium $R = mg$ seen or implied.	

B1	$F = \frac{1}{7}R$ seen or implied.	
M1	Use of N2L. Correct number of terms and dimensionally correct. Note: $-\frac{1}{7}mg = ma$ implies first 3 marks. M0 if $a = \pm 1.4$ with no evidence of $F = ma$ or $\pm\frac{g}{7}$	
A1	Correct acceleration, accept $\pm\frac{g}{7}$	
M1	Correct method using relevant *suvat* equation(s) from *A* to *B* to form an equation in *U* and *a* only. M0 for use of $a = \pm g$	
A1*	Obtain given answer from complete and correct working. Must use $g = 9.8$. Allow use of $a = 0.67U$ or better. Must reach $U = 2.1$ or $2.1 = U$.	
5(b)		
M1	Correct method using relevant *suvat* equation(s) from *B* to *C* to form an equation in *t* (and *U*). Must use $\frac{U}{2}$ and $\frac{U}{3}$ or numerical equivalent. Use of their acceleration for the method mark $(a \neq \pm g)$	
A1	Correct unsimplified equation in *t* only	
A1	Correct answer, 2sf following use of $g = 9.8$ ms^{-2}	
5(c)		
M1	Complete method to find the distance from *A* to *C*. Relevant *suvat* equation(s) for the full time period. Accept in terms of *U* for the method mark. Use of their acceleration for the method mark $(a \neq \pm g)$	
A1ft	Correct unsimplified equation. Follow through their "0.25".	
A1	Correct answer	

Question Number	Scheme	Marks
6 (a)	$\sqrt{10^2+15^2}$	M1
	$\sqrt{325}$ or $5\sqrt{13}$ (km h^{-1})	A1
		(2)
(b)	$\tan\theta = \pm\frac{10}{8}$ or $\tan\theta = \pm\frac{8}{10}$ o.e.	M1
	A correct relevant angle 51.340… or 38.659…	A1
	 Bearing = 321 $(^\circ)$	A1
		(3)
(c)	Method to find $\overrightarrow{SB}$ using difference of general position vectors.	M1
	Correct expression for S at time t $t(10\mathbf{i}+15\mathbf{j})$	A1
	Correct expression for B at time t $(50\mathbf{i}+10\mathbf{j})+t(-8\mathbf{i}+10\mathbf{j})$	A1
	$\overrightarrow{SB} = [(50\mathbf{i}+10\mathbf{j})+t(-8\mathbf{i}+10\mathbf{j})]-[t(10\mathbf{i}+15\mathbf{j})]$ Leading to $\overrightarrow{SB} = [(50-18t)\mathbf{i}+(10-5t)\mathbf{j}]$ *	A1*
		(4)
(d)	Equate each component of $\overrightarrow{SB}$ to zero	M1
	$50-18t=0 \Rightarrow t=\frac{25}{9}$ $10-5t=0 \Rightarrow t=2$	A1
	Times are not the same $\Rightarrow$ B and S do not collide	A1*
		(3)
(e)	Equate **i** and **j** components of $\overrightarrow{SB}$ $50-18t=10-5t$	M1
	$t=\frac{40}{13}$	A1
	Method to find distance, $\lvert\overrightarrow{SB}\rvert$ $d=\sqrt{\left(50-18\times\frac{40}{13}\right)^2+\left(10-5\times\frac{40}{13}\right)^2}$	dM1
	Correct answer = 7.6 (km) or better	A1
		(4)
		(16)
	Notes for Question 6	
6(a)		

M1	Correct use of Pythagoras. May be implied by a correct answer.	
A1	Must be exact.	
6(b)		
M1	Correct use of trigonometry to find a relevant angle.	
A1	Correct relevant angle seen eg 51.350… , 38.659…, Accept $\tan^{-1}\left(\frac{8}{10}\right), \tan^{-1}\left(\frac{10}{8}\right)$	
A1	Correct answer, must be to the nearest degree.	
6(c)		
M1	Method to find $\overrightarrow{SB}$. Must subtract two general position vectors of the form $\mathbf{r}_0 + t\mathbf{v}$ (accept collected **i** and **j**).	
A1	Correct expression for position of the ship at time t.	
A1	Correct expression for the position of the boat at time t.	
A1*	Obtain given answer from complete and correct working. Accept working in column vectors. Final answer must have correct **i**–**j** notation. Accept $\overrightarrow{SB}$ or SB. Allow missing units.	
(d)		
M1	Equate both **i** and **j** components to zero	
A1	Correct values for t	
A1*	Obtain given answer from fully correct working with conclusion. E.g. Following correct t values: 'do not collide'	
(d) ALT 1		
M1	Method to find the minimum value of d or d^2 $(349t^2 - 1900t + 2600)$ Eg • Completes the square: $349\left(t - \frac{950}{349}\right)^2 + \frac{4900}{349}$ • Differentiates and setting equal to 0: $698t - 1900 = 0 \quad \Rightarrow \quad t = \frac{950}{349}$ • Calculator: $\min d^2 = 14.04...$ or $\min d = 3.747...$ when $t = \frac{950}{349}$	
A1	Correct value for min d or d^2 identified: $\frac{4900}{349}$ or $\sqrt{\frac{4900}{349}}$	
A1*	Conclusion following correct working.	
(d) ALT 2		
M1	Method to find there are no real roots of the quadratic $349t^2 - 1900t + 2600$. May use the quadratic formula or discriminant or calculator but there must be evidence of finding 'no real roots', not just a statement.	
A1	• $d = \frac{1900 \pm \sqrt{1900^2 - 4(349)(2600)}}{2(349)} \Rightarrow$ roots $\frac{950 \pm 70i}{349}$ • Discriminant $= 1900^2 - 4(349)(2600) = -19\,600 < 0$	

A1*	**No real roots** oe so never collide. **N.B**. Must see justification for 'no real roots' to score either of the A marks. Correct conclusion from correct working	
(e)	**N.B.** For the last 2 marks, send the item to Review if a candidate appears to be affected by the SW/NE error.	
M1	Equate **i** and **j** components to find an equation in t	
A1	Correct value for t. Accept 3.1 or better.	
dM1	Dependent on previous M. Method to find distance using Pythagoras (square and add terms of $\overrightarrow{SB}$).	
A1	$\frac{70\sqrt{2}}{13}$ or 7.6 (km) or better (calculator display 7.614996105) Award at the point of a correct numerical expression then ISW	

Question Number	Scheme	Marks
	(a) On point of slipping **down** plane  (b) Starts to move **up** the plane  	
7(a)	Method to form an equation in F only.	M1
	Either whole system: $F+0.45g+0.2g=g\sin\theta$ Or two equations and eliminate T	A1
	For P: $T+F=g\sin\theta$ For bucket and block: $T=0.45g+0.2g$	A1
	Perpendicular equilibrium for P	M1
	$R=g\cos\theta \quad \left(=\frac{3}{5}g\right)$	A1
	Use of $F=\mu R$ and correct trig ratios	M1
	$\mu=\frac{1}{4}$*	A1*
		(7)
(b)(i)	Method to form an inequality or equation in n only	M1
	Either whole system: $0.45g+0.2ng>g\sin\theta+F$ Or two inequalities and eliminate T For P: $T>F+g\sin\theta$ For bucket and blocks: $0.45g+0.2ng>T$	A1
	Leads to $n>2.5$ (or n =2.5) so $n=3$	A1
(ii)	Method using N2L to form an equation in a only	M1
	Either whole system: $0.45g+0.2(3)g-g\sin\theta-F=(1+0.45+0.2(3))a$ $0.45g+0.6g-\frac{4}{5}g-\frac{3}{20}g=2.05a$	A1
	Or two equations and eliminate T For P: $T-g\sin\theta-F=a$ For bucket and blocks: $0.45g+0.2(3)g-T=(0.45+0.2(3))a$	A1
	$a=0.48$ or 0.478 (m s^{-2})	A1
		(7)

		(14)
	Notes for Question 7	
7(a)		
M1	Complete method to form an equation in F (or μR) only. May use equilibrium or N2L with $a = 0$ (whole system or two equations and eliminate T). Dimensionally correct, correct no of terms, condone sin/cos confusion, condone sign errors. M0 if a is never equal to zero.	
A1	Correct unsimplified equation in F with at most one error (or μR)	
A1	Correct unsimplified equation in F (or μR)	
M1	Perpendicular equilibrium to find an expression for R, condone sin/cos confusion.	
A1	Correct unsimplified expression for R	
M1	Use of $F = \mu R$ and correct trig ratios. Must use μR with their R in an attempt at N2L ($a = 0$ or $a \neq 0$)	
A1*	Obtain given answer from complete and correct working. Must see sufficient working with the equilibrium equation and the given answer. Must have clear use of $a = 0$ if using N2L. A0* for $\mu = 0.25$	
7(b) (i)	Marks parts (i) and (ii) together if required	
M1	Complete method to form an equation/inequality in n only. May use equilibrium or N2L (whole system to two equations and eliminate T). Dimensionally correct, correct no of terms, condone sin/cos confusion, condone sign errors. Accept method using $(0.45g + 0.2ng)$ or $(0.65g + 0.2ng)$ Accept a systematic method adding blocks ($n = 2$ and 3). In each trial, must make a comparison. $\left(\text{useful values: } g\sin\theta + F = \frac{19}{20}g \text{ and } F = \frac{3}{20}g = 1.47\right)$	
A1	Correct unsimplified equation or inequality.	
A1	Correct value of n	
7(b)(ii)		
M1	Use of N2L to form an equation in a only (whole system or two equations and eliminate T). Dimensionally correct, correct no of terms, condone sin/cos confusion, condone sign errors. Allow with their calculated n if used consistently on both sides.	
A1	Correct unsimplified equation with at most one error. Note: repeated use of incorrect n is one error eg n =2, 2.5, 4 and use of $n = 3$ from an incorrect method is one error (fortuitous)	
A1	Correct unsimplified equation.	
A1	Accept $\frac{2g}{41}$	