



Complete, fold and seal
(see note 2 below)

SURNAME: Coughlin

FORENAME(S): Leighton Joseph

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
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ve it typed and the expense of typing

Months Ago

Very Good

Shame about Q2

Shuler

1	Student Number	1802971
2	Title of Examination Paper	Engineering Science
3	Module Code	M4X02192
4	Date and Time of Examination	January 2019
5	Examination Venue	vivian hall
6	Seat Number	G065
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use	
1	28	28
2	8	17
3	16	20
4	10	10
Total	62	75

Omitting
Q3b)

$$\frac{60}{70} = 86\%$$

83%

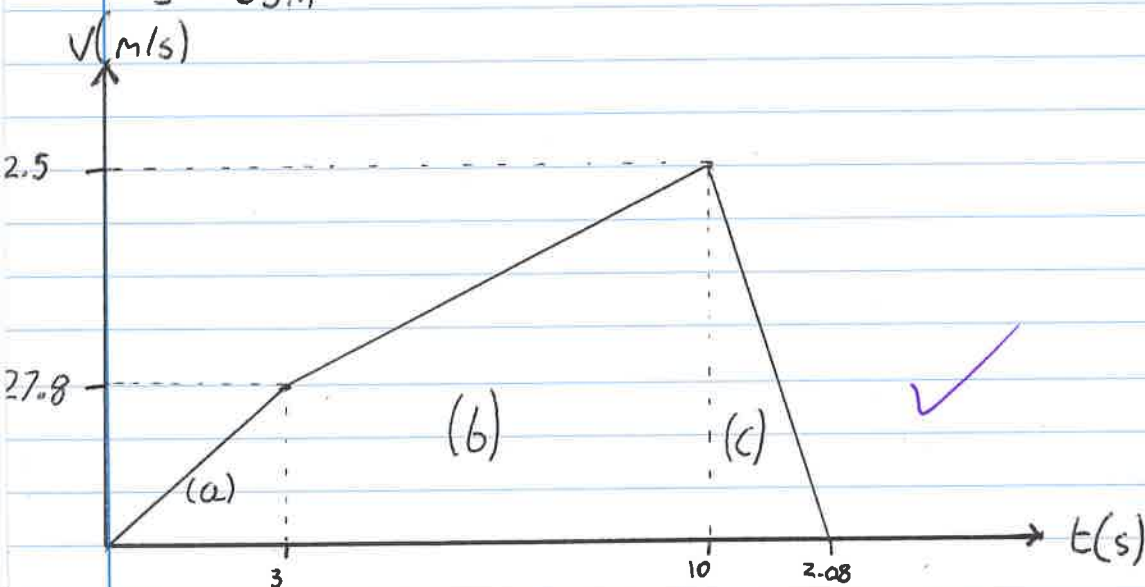
1) $u = 0$
 $v = 100 \text{ km/h}$ $100 \times \frac{1000}{3600} = 27.7$ or 27.8 m/s (1dp)
 $t = 3 \text{ s}$

$$u = 27.8 \text{ m/s}$$

$$v = 225 \text{ km/h} \quad 225 \times \frac{1000}{3600} = 62.5 \text{ m/s}$$

$$t = 10 \text{ s}$$

$$s = 65 \text{ m}$$



a) $V = u + at$

$$a = \frac{v - u}{t}$$

$$a = \frac{27.8 - 0}{3}$$

$$a = 9.26 \text{ m/s}^2$$

b) $V = u + at$

$$a = \frac{v - u}{t}$$

$$a = \frac{62.5 - 27.8}{10}$$

$$a = 3.47 \text{ m/s}^2$$

$$c) S = \frac{(u+v)t}{2}$$

$$2S = (u+v)t$$

$$\frac{2S}{t} = u+v$$

$$\frac{2S}{u+v} = t$$

$$v = 0$$

$$u = 62.5 \text{ m/s}$$

$$S = 65 \text{ m}$$

$$t = \frac{2S}{u+v}$$

$$t = \frac{2 \times 65}{62.5 + 0}$$

$$t = \underline{\underline{2.08 \text{ s}}}$$



d) looking at part (a) of the graph

$$S = \frac{(u+v)t}{2}$$

$$S = \frac{(0 + 27.8)3}{2}$$

$$S = 41.7 \text{ m}$$

looking at part (b) of the graph

$$S = \frac{(u+v)t}{2}$$

$$S = \frac{(27.8 + 62.5)10}{2}$$

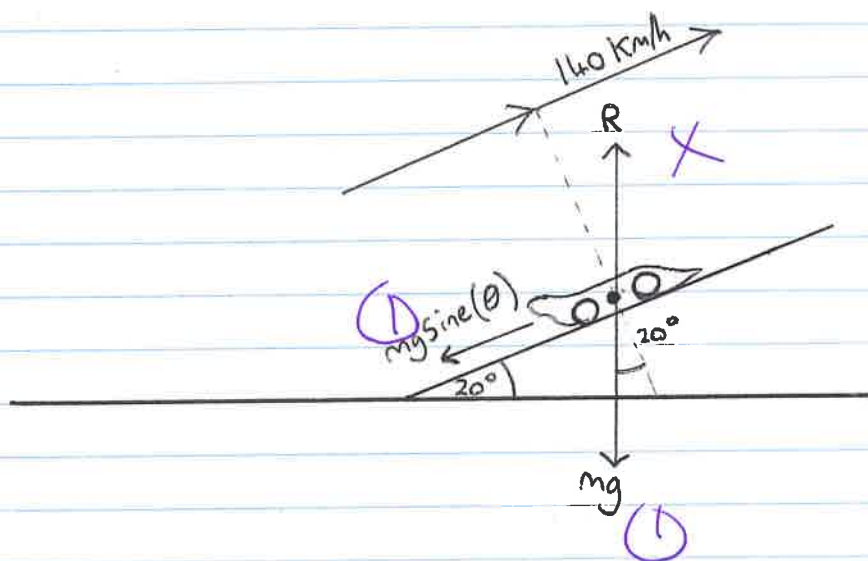
$$S = 451.5 \text{ m}$$

Excellent!

Part (c) = 65m

∴ the total displacement =
 $65 + 41.7 + 451.5 = \underline{\underline{558.2\text{m}}}$

2)



$\theta = 20^\circ$

$v = 140 \text{ km/h}$ or 38.9 m/s $140 \times \frac{1000}{3600} = 38.9 \text{ m/s}$ (1dp)

$m = 888 \text{ kg}$

$P = 150 \text{ kW}$ or $150,000 \text{ W}$

$P = Fv$

$F = \frac{P}{v}$

$F = \frac{150,000}{38.9}$

$F = 3856.04 \text{ N (2dp)}$

$F = \mu R$

$R = mg$

$F = \mu mg$

$\frac{F}{mg} = \mu$

$\mu = \frac{3856.04}{888 \times 9.81}$

$\mu = 0.44$ (no units)

3) $\omega = 20,000 \text{ RPM}$ or 2094.395 rad/s $20,000 \times \frac{2\pi}{60} = 2094.395$
 $t = 0.5 \text{ s}$
 $\tau = 145 \text{ Nm}$ ✓

a) $I = ?$

$$\omega_2 = \omega_1 + \alpha t$$

$$\alpha = \frac{\omega_2 - \omega_1}{t}$$

$$\alpha = \frac{2094.395 - 0}{0.5}$$

$$\alpha = 4188.79 \text{ rad/s}^2$$
 ✓

$$\tau = I \alpha$$

$$I = \frac{\tau}{\alpha}$$

$$I = \frac{145}{4188.79}$$

$$I = 0.03 \text{ kg/m}^2 \text{ (zdp)}$$
 ✓

⑨

b) $I = m k^2$

$$k = 260 \text{ mm or } 0.26 \text{ m}$$

$$m = \frac{I}{k^2}$$

$$m = \frac{0.03}{0.26^2}$$

$$m = 0.44 \text{ kg (zdp)}$$

②

Shame.

c) $P = \tau \omega$

$$P = 145 \times 2094.395$$

$$P = 303687.275 \text{ W or } 303.69 \text{ kW (zdp)}$$

③

$$d) k_e = \frac{1}{2} I \omega^2$$

$$k_e = \frac{1}{2} \times 0.03 \times 2094.395^2$$

$$k_e = 65,797.35624 \text{ J or } 65.8 \text{ kJ (2dp)}$$

(2)

Rounding error.

4) a) ~~8~~

$$n = 0.65 \text{ Hz}$$

$$n = \frac{\omega}{2\pi}$$

$$\omega = n \times 2\pi$$

$$\omega = 0.65 \times 2\pi$$

$$\omega = \underline{\underline{4.08 \text{ rad/s}}}$$



$$b) T = \frac{2\pi}{\omega}$$

$$T = \frac{2\pi}{4.08}$$

$$T = 1.54 \text{ s (2dp)}$$



$$c) F_{\max} = m \omega^2 A$$

$$A = 1750 \text{ mm or } 1.75 \text{ m}$$

$$F_{\max} = 10 \text{ kN or } 10,000 \text{ N}$$

$$\omega = 4.08 \text{ rad/s}$$

$$m = \frac{F_{\max}}{\omega^2 A}$$

$$m = \frac{10000}{4.08^2 \times 1.75}$$

$$m = \underline{\underline{343.27 \text{ kg (2dp)}}}$$



Question No.

Examiner

Arholwr yn unig

y Cwestiwn

Question No.

Examiner O

Arholwr yn unig

f y Cwestiwn

Question No.

Examiner O

Arholwr yn unig

f y Cwestiwn

~~but~~ $V = u + at$

$$V^2 = u^2 + 2as$$

$$S = ut + \frac{1}{2} at^2$$

$$S = \frac{(u+v)t}{2}$$

$$\omega_2 = \omega_1 + \alpha t$$

$$\omega_2^2 = \omega_1^2 + 2\alpha \theta$$

$$\theta = \omega_1 t + \frac{1}{2} \alpha t^2$$

$$\theta = \frac{(\omega_1 + \omega_2)t}{2}$$

Cyfarwyddiadau i Ymgeiswyr

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhowch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan dddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgrifen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.

4. Ysgirfennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllywr/gwylwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchriadu.

7	Nifer y Llyfrau Atebion a gyllwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

[illegible]

(See the other side for English version)

Лленвч, плгвч а селвч
(gweier nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:



Prifysgol Cymru

Y Drindod Dewi Sant

University of Wales

Trinity Saint David

Examination Answer Books

12 Pages

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Marked Agreed
Diet.

1	Student Number	1801879
2	Title of Examination Paper	Engineering Science #
3	Module Code	~~MA X00385~~ M4X02192
4	Date and Time of Examination	16 th January 12:00
5	Examination Venue	IQ, Room 108
6	Seat Number	
7	Number of Answer Books handed in	1

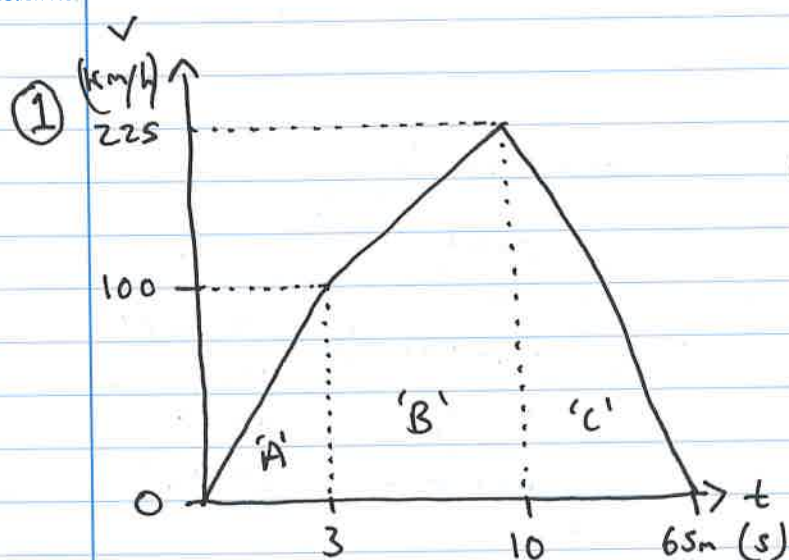
List the numbers of the questions you have attempted	Office Use	
1	28	28
2	4	17
3	16	20
4	9/10	10
Total	61 ~~10~~	75

Quitting
(Q3b)

$$\frac{60}{70} = 86\%$$

8%

~~80%~~



$$100 \text{ km/h} \times \frac{1000}{3600} = 27.78 \text{ m/s}$$

$$225 \text{ km/h} \times \frac{1000}{3600} = 62.5 \text{ m/s}$$

A)

$$\begin{array}{l} v = u + at \\ -u \quad -u \\ \div t \quad \div t \\ \hline \frac{v-u}{t} = a \end{array}$$

$$\begin{array}{l} a = \frac{v-u}{t} \\ a = \frac{27.78-0}{3} \\ a = 9.26 \text{ m/s}^2 \end{array}$$

Acceleration from 0-100km/h = 9.26 m/s²

B)

$$a = \frac{v-u}{t}$$

$$a = \frac{62.5 - 27.78}{10}$$

$$a = 3.47 \text{ m/s}^2$$

Acceleration from 100km/h-225km/h = 3.47 m/s²

C)

$$s = \frac{(v+u)t}{2}$$

x2

x2

$$2(s) = (v+u)t$$

$$(\div v+u) \quad \div (v+u)$$

$$\frac{2(s)}{v+u} = t$$

$$t = \frac{2 \times 65}{0+62.5}$$

$$t = 2.08 \text{ seconds}$$

Braking time = 2.08 seconds

①

D)

Looking at 'A':

$S = ?$

$u = 0$

$v = 27.78 \text{ m/s}$

$A = -$

$T = 3 \text{ Seconds}$

$S = \frac{(v+u)t}{2}$

$S = \frac{(27.78+0)3}{2}$

$S = 41.67 \text{ m}$

Looking at 'B':

$S = \frac{(v+u)t}{2}$

$S = ?$

$u = 27.78$

$S = \frac{(62.5+27.78)10}{2}$

$v = 62.5$

$A = -$

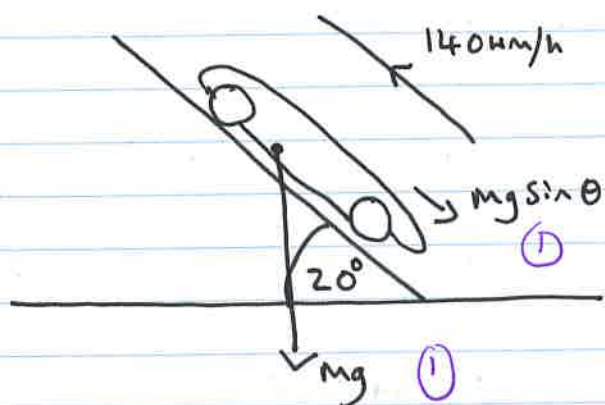
$S = 451.4 \text{ m}$

$T = 10 \text{ s}$

$$\text{Total displacement} = 41.67 + 451.4 + 65 = \underline{558.07 \text{ m}}$$



②



$$m = 888 \text{ kg}$$

$$v = 140 \text{ km/h} \times \frac{1000}{3600} = 38.89 \text{ m/s}$$

$$g = 9.81 \text{ m/s}^2$$

$$\theta = 20^\circ$$

$$P = 150 \text{ kW} \times 1000 = 150000 \text{ Watts}$$

$$Mg \sin(20^\circ)$$

$$\frac{P}{v} = F$$

$$F = \frac{P}{v}$$

$$F = \frac{150000}{38.89}$$

$$F = 3857.03 \text{ N}$$

$$\frac{F}{R} = \mu$$

$$\mu = \frac{F}{R}$$

$$\mu = \frac{3857.03}{Mg \sin \theta}$$

$$\mu = \frac{3857.03}{888 \times 9.81 \times \sin(20^\circ)}$$

$$\mu = 1.29 \text{ (no units)}$$

$$\mu = \frac{F}{R}$$

$$\mu = \frac{3857.03}{Mg \sin \theta + 3857.03}$$

$$\mu = \frac{3857.03}{888 \times 9.81 \times \sin(20^\circ) + 3857.03}$$

$$\mu = 0.56 \text{ (no units)}$$

Coefficient of friction = 0.56 (no units)

③ $\omega = 20000 \text{ rpm} \times \frac{2\pi}{60} = 2094.40 \text{ rad/s}$
 $T = 145 \text{ Nm}$
 $t = 0.5 \text{ seconds}$

A)

$$\begin{array}{l|l} \omega_2 & \omega_1 + \alpha t \\ -\omega_1 & -\omega_1 \\ \div t & \div t \\ \hline \frac{\omega_2 - \omega_1}{t} & \alpha \end{array}$$

$$\begin{array}{l|l} \alpha & \frac{\omega_2 - \omega_1}{t} \\ \alpha & \frac{2094.40 - 0}{0.5} \\ \alpha & 4188.8 \text{ rad/s}^2 \end{array}$$

$$\begin{array}{l|l} T & I \times \alpha \\ \div \alpha & \div \alpha \\ \hline \frac{T}{\alpha} & I \end{array}$$

$$\begin{array}{l|l} I & \frac{T}{\alpha} \\ I & \frac{145}{4188.8} \\ I & 0.035 \text{ kgm}^2 \end{array}$$

9

Mass moment of inertia = 0.035 kgm²

B)

$$\begin{array}{l|l} k & \frac{d^2}{2} \\ k & \frac{260^2 \cdot 0.26^2}{2} \\ k & 0.034 \text{ m} \end{array}$$

$$k^2 = \frac{d^2}{8}$$

Shame!

$$260 \text{ mm} \div 1000 = 0.26 \text{ m}$$

$$\begin{array}{l|l} I & m \times k^2 \\ \div k^2 & \div k^2 \\ \hline \frac{I}{k^2} & m \end{array}$$

$$\begin{array}{l|l} m & \frac{0.035}{0.034^2} \\ m & 30.28 \text{ kg} \end{array}$$

1

Mass of rotating part = 30.28 kg

③

c)

$$P = T \times \omega$$

$$P = 145 \times 2094.40$$

$$P = 303,688 \text{ watts}$$

$$P = 303.69 \text{ kW}$$

$$\text{Power developed} = 303.69 \text{ kW}$$

✓ ③

d)

$$K.E = \frac{1}{2} \times I \times \omega^2$$

$$K.E = \frac{1}{2} \times 0.035 \times 2094.40^2$$

$$K.E = 76,763.95 \text{ Joules}$$

$$K.E = 76.76 \text{ kW}$$

$$I = 0.035 \text{ kgm}^2$$

$$\omega = 2094.40 \text{ rad/s}$$

✓ ③

$$\text{Maximum Kinetic Energy} = 76.76 \text{ kW}$$

(4)

$$n = 0.65 \text{ Hz}$$

$$r = 1750 \text{ mm} \div 1000 = 1.75 \text{ m}$$

A)

$$\begin{array}{l} n = \frac{\omega}{2\pi} \\ \times 2\pi \\ n \times 2\pi = \omega \end{array}$$

$$\omega = 0.65 \times 2\pi$$

$$\omega = 4.08 \text{ rad/s}$$

$$\text{Angular velocity} = \frac{4.08}{4.08} \text{ rad/s}$$

(4)

✓

B)

$$\begin{array}{l} T = \frac{2\pi}{4.08} \\ T = 1.54 \text{ seconds} \end{array}$$

~~Shone +~~
1 Mj Bad (2)

✓

$$\text{Periodic time} = 1.54 \text{ Seconds}$$

C)

$$10 \text{ kN} \times 1000 = 10,000 \text{ N}$$

$$\begin{array}{l} F_{\text{MAX}} = m \times \omega^2 \times A \\ \div (\omega^2 \times A) \end{array}$$

$$\frac{F_{\text{MAX}}}{\omega^2 \times A} = m$$

$$\frac{10,000}{4.08^2 \times 1.75} = 343.27 \text{ kg}$$

✓ 4

$$\text{Maximum Mass} = 343.27 \text{ kg}$$

Question No.

Examiner O

Arholwr yn unig

liff y Cwestiwn

Question No.

Examiner On

Arholwr yn unig

nif y Cwestiwn

Question No.

Examiner Only

Arholwr yn Unni

Rhif y Cwestiwn

Question No.

Examiner Or

Arholwr yn unig

iff y Cwestiwn

Llenwch, plygwrch a seliwrch
(gweler nodyn 2 isod)

8. Rhaid dychwelyd pob llyfr. Ni chanafeir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

[illegible]



**Complete, fold and seal
(see note 2 below)**

LYNN

FORENAME(S):

THOMAS

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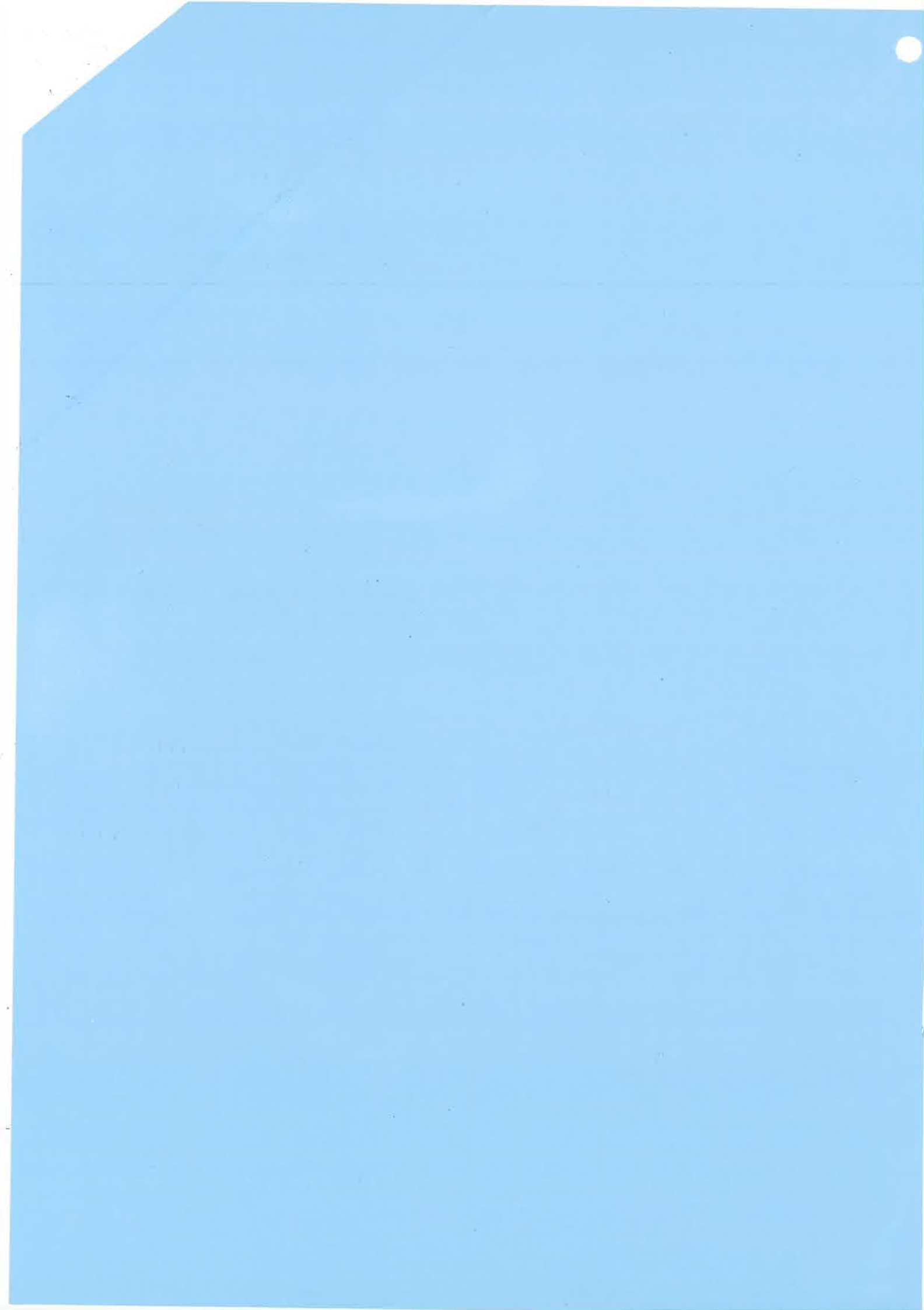
Mark Arnold
Chair

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3	9	20
4	8	10
Total	51	75

Omitting
Q3b)

$$\frac{50}{70} = 71\%$$

68%



$$\omega^2 = \omega' + \alpha t$$

$$\omega^2 = \omega_1^2 + 2\alpha\theta$$

$$\theta = \frac{1}{2}\omega_1 t + \alpha t^2$$

$$\theta = \frac{(\omega^2 + \omega')}{2} t$$

$$v = r\omega$$

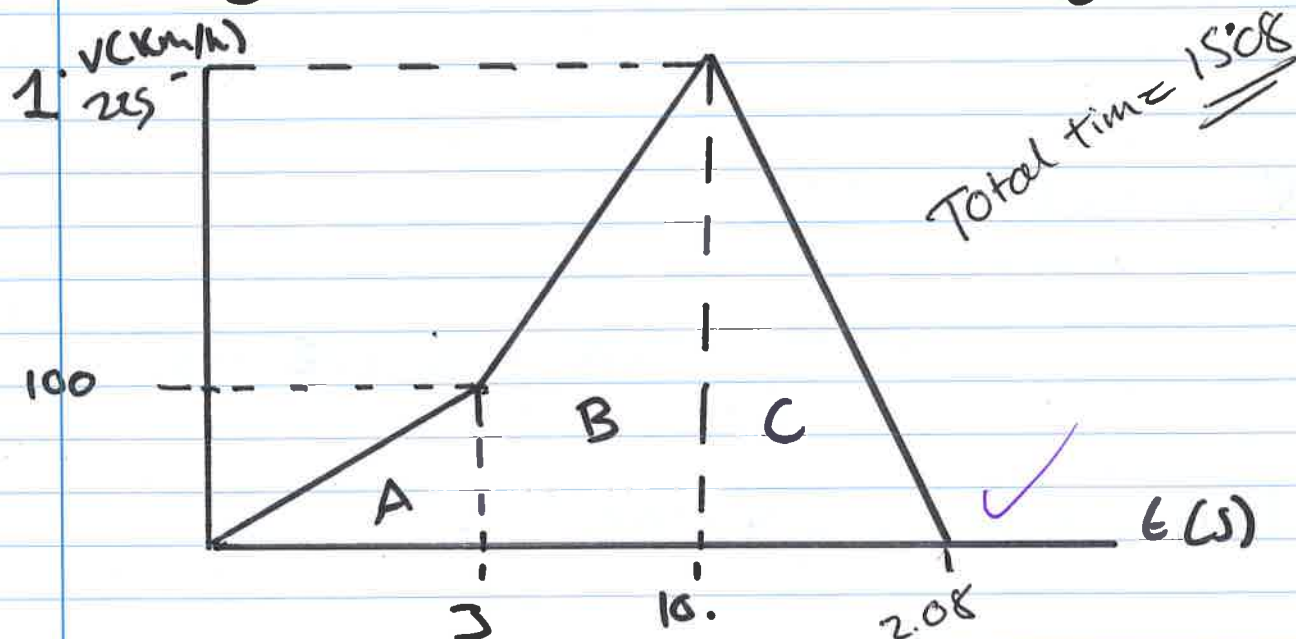
$$a = r\alpha$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = \frac{1}{2}ut + at^2$$

$$s = \frac{(u+v)}{2} t$$



a. - Acceleration. - Looking @ 'A'

$$u = 0$$

$$v = 100 \text{ km/h} = 27.78 \text{ m/s}$$

$$a = ?$$

$$t = 3$$

$$v = u + at = \frac{v-u}{t} = a$$

$$\frac{v-u}{t}$$

$$= \frac{27.78 - 0}{3} = 9.26 \text{ m/s}^2$$

$$\text{Acceleration} = 9.26 \text{ m/s}^2$$

b. Acceleration = Looking @ 'B'

$$u = 100 \text{ km/h} = 27.78 \text{ m/s}$$

$$v = 225 \text{ km/h} = 62.5 \text{ m/s}$$

$$t = 10 \text{ s}$$

$$v = u + at \Rightarrow \frac{v - u}{t} = a$$

$$= \frac{62.5 - 27.78}{10} = 3.47 \text{ m/s}^2$$

Acceleration = 3.47 m/s²

c. $v = 62.5 \text{ m/s}$ $s = \frac{(u+v)t}{2}$
 $u = 0 \text{ m/s}$
 $s = 65 \text{ m}$

$$2s = (u+v)t$$

$$\frac{2s}{u+v} = t = \frac{2 \times 65}{0 + 62.5} = 2.08 \text{ s.}$$

Time = 2.08 s.

d. Looking at 'A'

$$S =$$

$$u = 0$$

$$v = 27.78 \text{ m/s}$$

$$a = 9.26 \text{ m/s}^2$$

$$t = 3$$

$$S = \frac{(u+v)t}{2}$$

$$S = \frac{(0 + 27.78) 3}{2} = \underline{41.67 \text{ m}}$$

Looking @ 'B'

$$S =$$

$$u = 27.78 \text{ m/s}$$

$$v = 62.5 \text{ m/s}$$

$$a = 3.47 \text{ m/s}^2$$

$$t = 10 \text{ s}$$

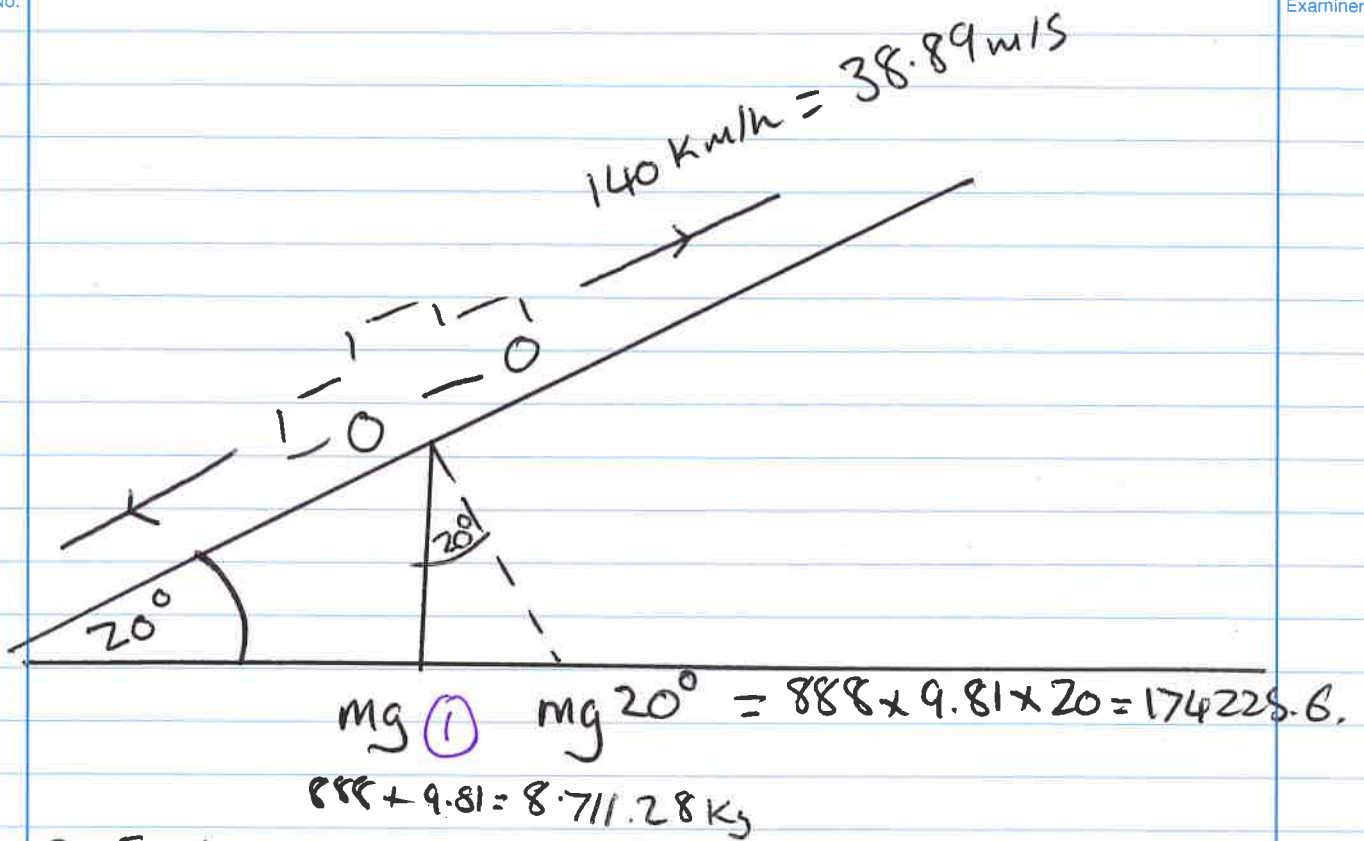
$$S = \frac{(u+v)t}{2}$$

$$S = \frac{(27.78 + 62.5) 10}{2} = 451.4 \text{ m}$$

$$\text{Total Distance} = 41.67 + 451.4 + 65 =$$

$$\underline{\underline{558.07 \text{ m}}}$$





$$P = F \times V$$

$$P = 150 \text{ kw} = 150000 \text{ W} \quad (1)$$

$$V = 38.89 \text{ m/s} \quad (1)$$

$$F = ?$$

$$F = \frac{P}{V} = \frac{150000}{38.89} = \underline{\underline{3857.03 \text{ N}}} \quad (3)$$

$$\text{Force} = \underline{\underline{3857.03 \text{ N}}}$$

$$F = \mu mg = \frac{F}{mg} = \mu \quad \times$$

$$= \frac{3857.03}{888 \times 9.81} = \underline{\underline{0.44 \text{ No units}}}$$

$$\text{Coefficient of friction} = \underline{\underline{0.44 \text{ No units.}}}$$

$$k^2 = \frac{d^2}{8}$$

Examiner Only

3. $\omega =$

$$\omega_1 = 0$$

$$\omega^2 = 2000 \text{ RPM} = 209.44 \text{ rad/s.}$$

$$\alpha =$$

x.

$$t = 0.5$$

$$T = 145 \text{ Nm}$$

~~6~~

a. Inertia $= I = mk^2$

Carried error

$$\frac{\omega^2 - \omega_1}{t} = \alpha = \frac{209.44 - 0}{0.5} = 418.88 \text{ rad/s}^2$$

Shame! (2)

$$T = I \alpha = \frac{T}{\alpha} = I = \frac{145}{418.88} = 0.35 \text{ kgm}^2$$

(2) Carried error

$$\text{Inertia} = \underline{\underline{0.35 \text{ kgm}^2}}$$

b. Mass $= I = mk^2 = \frac{I}{k^2} = m$

~~$$k^2 = \frac{d^2}{8} = \frac{260 \text{ mm}^2}{8} = \frac{0.26^2}{8} = 8.45 \text{ m}$$~~

~~$$m = \frac{0.35}{8.45} = 0.04 \text{ kg} \quad \text{mass} = \underline{\underline{0.04 \text{ kg}}}$$~~

Shame!

$$\text{mass} = I = mk^2 = m = \frac{I}{k^2} \quad (1)$$

$$= m = \frac{0.35}{0.26^2} = 5.18 \text{ kg}$$

$$\text{Mass} = \underline{\underline{5.18 \text{ kg}}}$$

x

C. Power. $= P = T\omega$

$$P = 145 \times 209.44 \text{ rad/s} = 30368.8 \text{ W}$$

Power = 30.37 kW (2)
Carried error

d. Kinetic energy = $KE = 0.5 \times I \times \omega^2$
 $= 0$

$$KE = 0.5 \times 0.35 \times 209.44^2 = 36.652 \text{ J}$$

$$= \cancel{0.03} \text{ } \underline{\underline{0.04 \text{ kJ}}}$$

$$KE = 7676.39 \text{ J}$$

(2)
Carried error

Kinetic Energy = 7.68 kJ

4. $A = 1750 \text{ mm} = 1.75 \text{ m}$
 $n = 0.65 \text{ Hz}$

a. Angular Velocity $= n = \frac{\omega}{2\pi}$

$$= n \times 2\pi = \omega$$

$$= 0.65 \times 2\pi = 4.08 \text{ rad/s}$$

Angular Velocity = 4.08 rad/s

b. Time $= T = \frac{2\pi}{\omega}$

$$T = \frac{2\pi}{4.08} = 1.54 \text{ s.}$$

Time = 1.54 s

c. Mass $= f_{\max} = m\omega^2 A$

$$\frac{f_{\max}}{\omega^2 A} = m$$

$$= \frac{10000}{(4.08^2 \times 1.75)} = 1400.56 \text{ kg.}$$

Total mass = 1400.56 kg

x Shame!

Question No.

Examiner Onl

Arholwr yn unig

hif y Cwestiwn

Question No.

Examiner Only

Question No.

Examiner Onl

Arholwr yn unig

hif y Cwestiwn

Question No.

Examiner Only

Arholwr yn unig

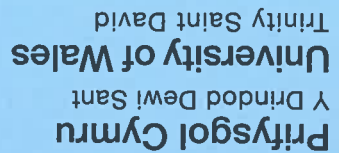
Rhif y Cwestiwn

Question No.

Examiner On

Arholwr yn unig

llyf y Cwestiwn



12 Tüdalen

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, pwygch e'f a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrifft annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgriennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwylwlr/gwylwyr.

8. Rhaid dychwelyd pob llyfr. Ni chanafeir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unthwy amgylchadau.

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Archoliad	
3	Cod y Modwl	
2	Telit y Papur Arholiad	
1	Rhif Myfyrwr	

[illegible]

(See the other side for English version)

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF:



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Examination Answer Books

12 Pages

Instructions to Candidates

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8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

Complete, fold and seal
(see note 2 below)

SURNAME:

Wright

FORENAME(S):

Alexander

1	Student Number	1701086
2	Title of Examination Paper	Engineering Science
3	Module Code	M4X02192 M4X
4	Date and Time of Examination	16/01/19 12:00
5	Examination Venue	W Vivian Hall
6	Seat Number	G069
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use*	
1	12	28
2	7	17
3	9	20
4	8	10
Total	36	75

Mark Awarded
28/28

Omitting
Q3b)

$$\frac{36}{70} = 51\%$$

48%



Answer

$$\theta = \frac{(\omega_2 - \omega_1)t}{2}$$

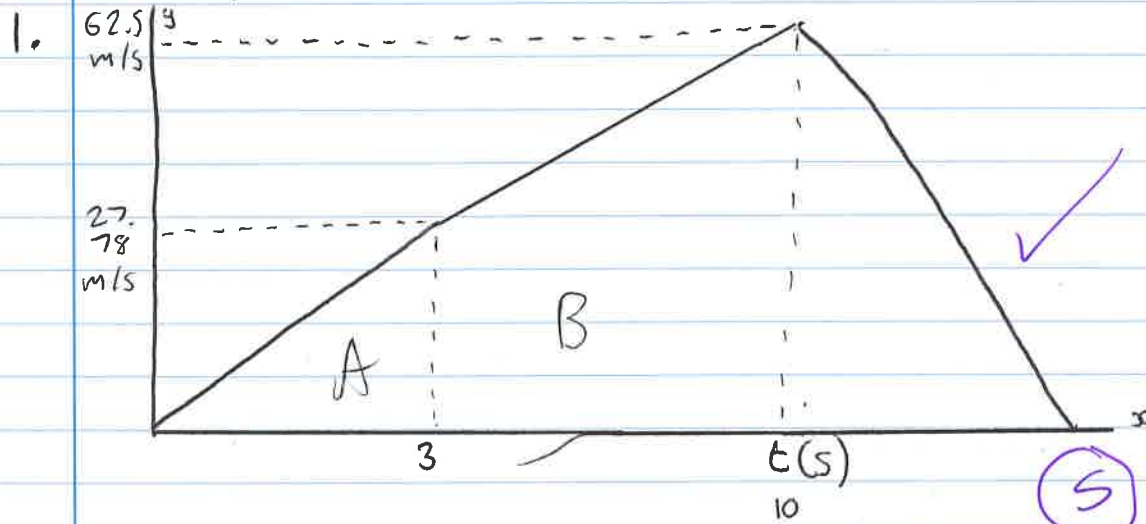
$$\omega_2 = \omega_1 + \alpha t$$

$$v = u + at$$

over the

$$\frac{v - u}{t} = a$$

v(m/s)



$$100 \text{ km/h} = \frac{100}{3.6} = 27.78 \text{ m/s}$$

$$225 \text{ km/h} = \frac{225}{3.6} = 62.5 \text{ m/s}$$

a) $a = \frac{v - u}{t}$

$$a = \frac{27.78 - 0}{3} = 9.26 \text{ m/s}^2$$

(6)

b) $a = \frac{62.5 - 27.78}{7}$

$$a = 4.96 \text{ m/s}^2$$

(7)

c) braking distance = 65m

d)

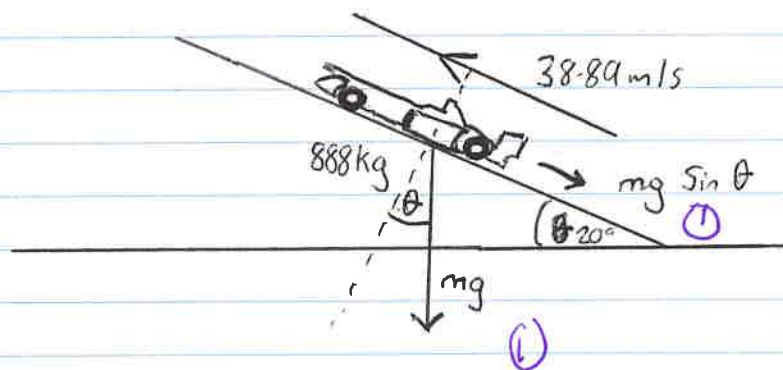
(A)

$$v = 27.78$$

$$u = 0$$

$$t = 3$$

2.



$$140 \text{ km/h} = \frac{140}{3.6} = 38.89 \text{ m/s} \quad (1)$$

$$P = 150 \text{ kW} = 150 \times 10^3 \text{ W} \quad (1)$$

$$v = 38.89 \text{ m/s}$$

$$F = ?$$

$$P = Fv \quad \frac{P}{v} = \frac{Fv}{v} \quad \frac{P}{v} = F$$

$$\frac{150 \times 10^3}{38.89} = 3857.03 \quad (2)$$

$$F = 3857.03 \text{ N}$$

$$F = \mu R \quad \frac{F}{R} = \frac{\mu R}{R} \quad \frac{F}{R} = \mu \quad (1)$$

$$\mu = \frac{3857.02}{888 \times 9.81} = 0.44 = \mu \quad \times$$

d) $K.E = \frac{1}{2} \times 4188.78 \times 2094.39^2 \times 0.5$

4.

a) $n = 0.65 \text{ Hz}$
~~100 mm~~ 1750 mm (1.75 m)

$$n = \frac{\omega}{2\pi} \quad n \times 2\pi = \omega$$

$$0.65 \times 2\pi = 4.08 \text{ rad/s} \quad \checkmark$$

b) $T = \frac{2\pi}{\omega}$

$$T = \frac{2\pi}{4.08} \quad T = 1.54 \text{ s} \quad \checkmark$$

c) $F_{\max} = 10 \text{ kN} \quad 10000 \text{ N}$

$$F_{\max} = m\omega^2 A \quad A = \frac{1.75}{2} = 0.875 \text{ m} \quad \times$$

$$\frac{F_{\max}}{\omega^2 A} = \frac{m\omega^2 A}{\omega^2 A} \quad \frac{F_{\max}}{\omega^2 A} = m$$

$$m = \frac{10000}{4.08 \times 0.875}$$

$$m = 2801.12 \text{ Kg} \quad \times$$

Question No.

Examiner Or

Arholwr yn unig

ty Cwestiwn

Question No.

Examiner On

Question No.

Examiner Only

Question No.

Examiner Qn

Arholwr yn unig

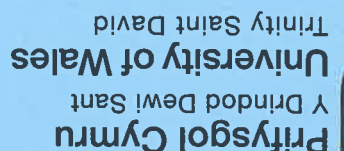
if y Cwestiwn

Question No.

Examiner On

Arholwr yn unig

ff y Cwestiwn



12 Tüdalen

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

1	Rhif Myfyriwr	
2	Teitl y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Archoliad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

Cyfanswm	
Rhestrwch ffâu'r ymgeisyddau a cwestiynau a gennyh	At Ddiarbenion y Swyddfa

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwylt/wr/gwylt/wr.

3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgrïp annarllennadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgrifennwch eich atebion mewn inc.



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

**Complete, fold and seal
(see note 2 below)**

SURNAME: Gordon

FORENAME(S): Oliver

Examination Answer Books

12 Pages

Instructions to Candidates

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8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

Manu Agred

1	Student Number	P150782
2	Title of Examination Paper	Engineering Science
3	Module Code	M4X02192
4	Date and Time of Examination	16/1/19
5	Examination Venue	Vivian hall Dylan Thomas Centre
6	Seat Number	G068
7	Number of Answer Books handed in	1

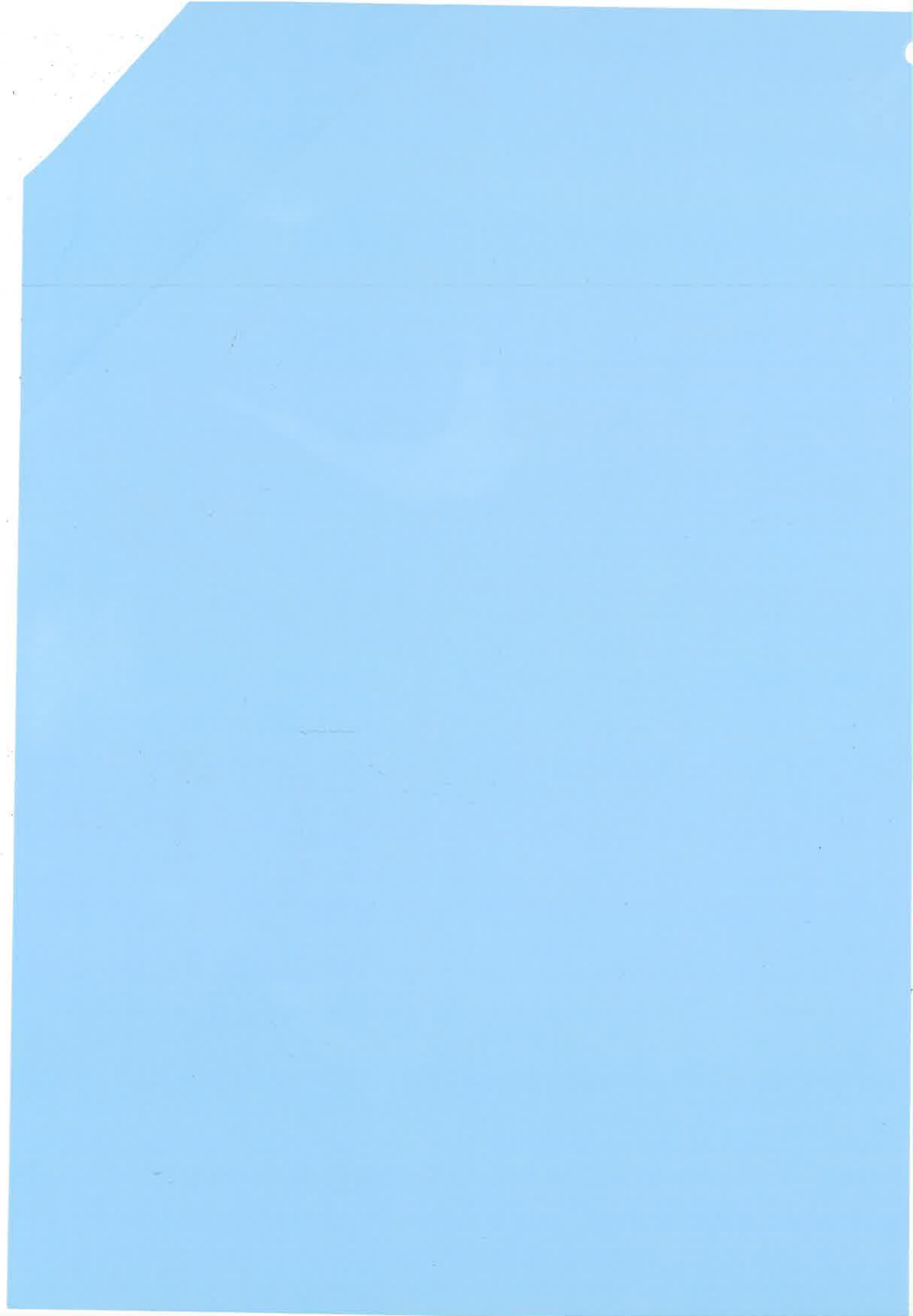
List the numbers of the questions you have attempted	Office Use	
1 ^{a B} c d	22	28
2 ^{a b}	7	17
3 ^{a B} c d	3	20
4 ^{a B} c	0	10
Total	32	75

Omitting
Q3 b)

$$\frac{32}{70} = 46\%$$

43 %

(Gweler yr ochr arall am y fersiwn Cymraeg)

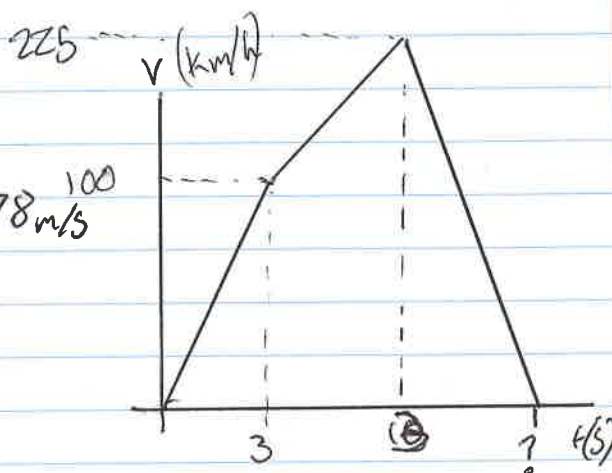


$$V = u + at$$

$$V^2 = u^2 + 2as$$

1) a) $100 \text{ km/h} \times \frac{1000}{3600} = 27.78 \text{ m/s}$

$$V = u + at \quad \frac{V - u}{t} = a$$



$$\frac{27.78 - 0}{3} = 9.259 \text{ m/s}^2$$

b) $u = 100 \text{ km/h} \times \frac{1000}{3600} = 27.78$
 $v = 225 \text{ km/h} \times \frac{1000}{3600} = 62.5$
 $t = 10$

$$\frac{V - u}{t} = a \quad \frac{62.5 - 27.78}{10} = 3.472 \text{ m/s}^2$$

c) $V^2 = u^2 + 2as$

$$\frac{V^2 - u^2}{2s} = a \quad \frac{62.5^2 - 27.78^2}{2(30.05)} = 3.472$$

$$65 \text{ m} \div 30.05 \text{ m/s} = 2.16 \text{ seconds}$$

Rounding error

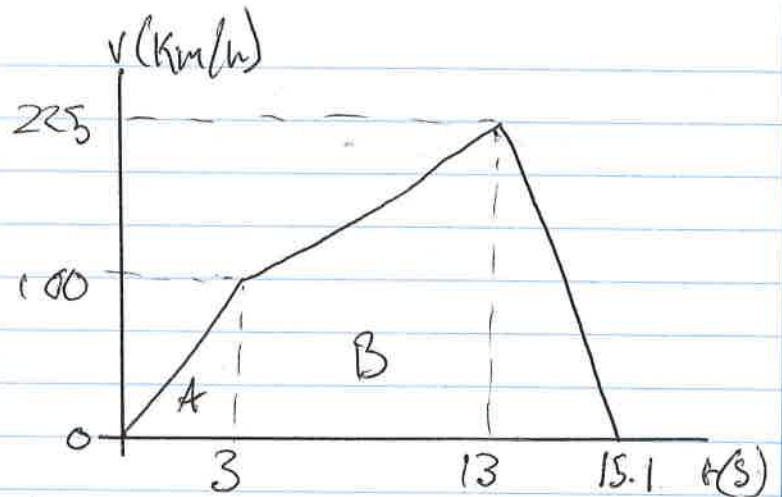
(3)

1) d)

$$s = \frac{(v+u)t}{2}$$

looking @ 'A'

$$\frac{(0 + 27.78) \times 3}{2} = 41.67 \text{ m}$$



looking @ 'B'

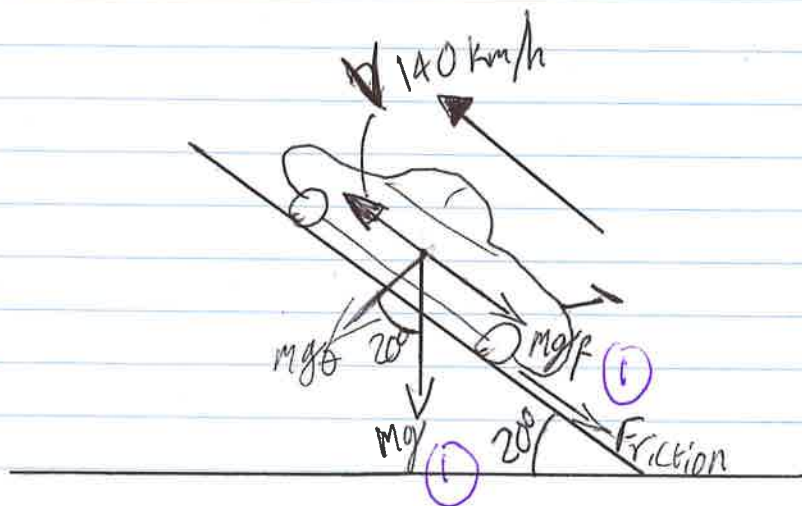
$$\frac{(62.5 + 27.78) \times 10}{2} = 451.4 \text{ m}$$

$$65 + 41.67 + 451.4 =$$

$$558.07 \text{ m}$$

✓ 8

2)



$$P = 150 \text{ kW} \quad 150000 \text{ Watts} \quad (1)$$

$$m = 888 \text{ kg}$$

$$v = 140 \times \frac{1000}{3600} = 38.89 \quad (1)$$

$$P = Fv$$

$$F = \frac{P}{v}$$

(3)

$$\frac{150000}{38.89} = 3857.03$$

3) $\omega = 20000 \text{ rpm} \times \frac{2\pi}{60} = 2094.4 \text{ rads}$ ✓

$T = 145 \text{ Nm}$

$T = I\alpha \quad I = \frac{T}{\alpha}$

$\frac{145}{2094.4} = 0.0692$

①

b) $r = 260 \text{ mm} \quad \frac{0.0692}{260^2} = 1.023 \times 10^6$

c) $P = T\omega \quad 145 \times 2094.4 = 303688 \text{ W}$

303.688 Kw

②.

d) ?

Q4 next page

Q4)

a)

$$\omega = ?$$

$$n = ?$$

$$T = 0.85 \text{ Hz}$$

b) ?

Question No.

Examine

Arholwr yn unig

Cwestiwn

Question No.

Examiner

Arholwr yn unig

/ Cwestiwn

Question No.

Examiner

Arholwr yn unig

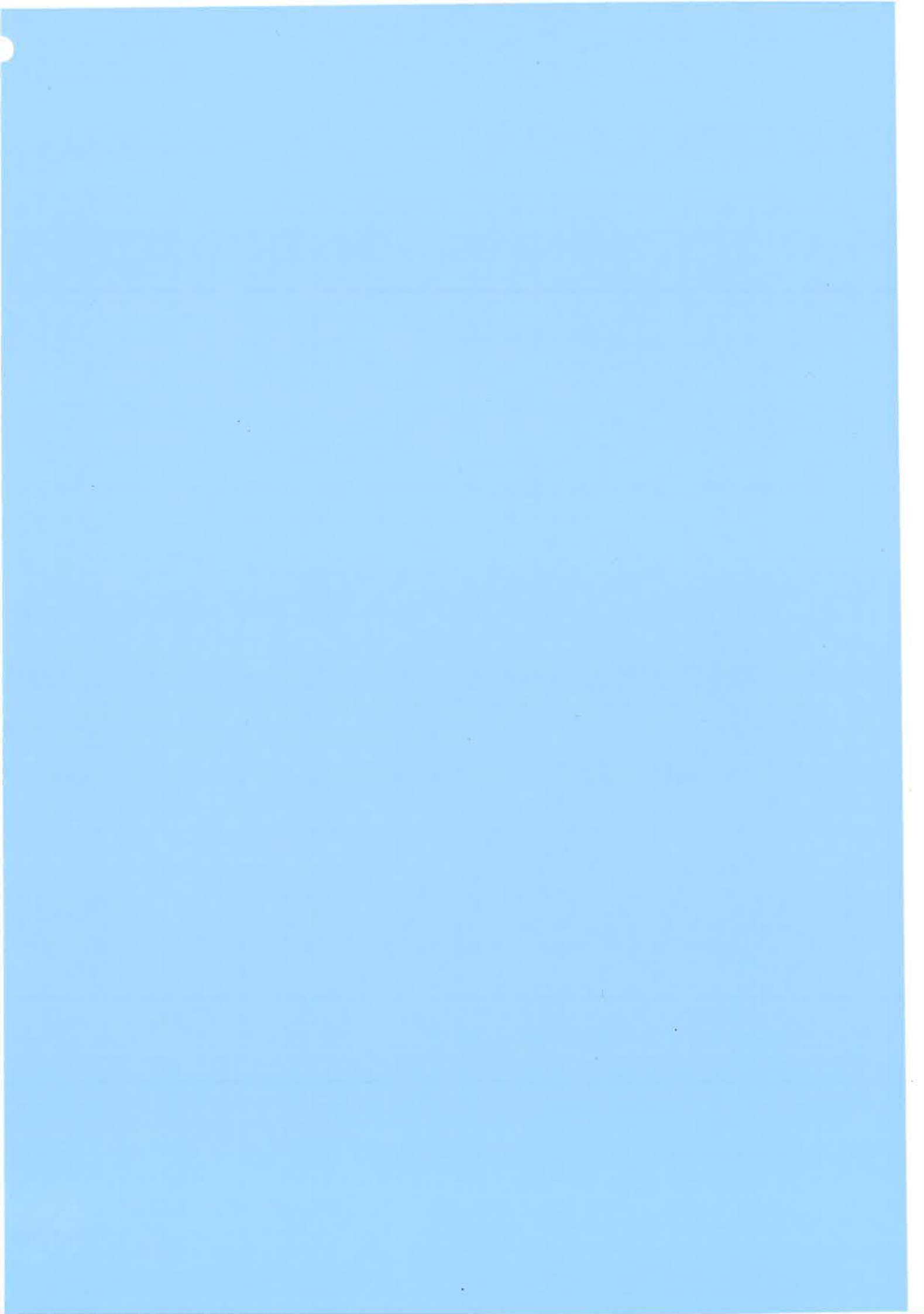
Y Cwestiwn

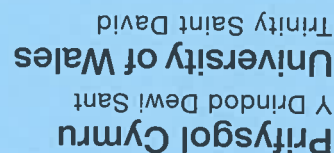
Question No.

Examine

Arholwr yn unig

Cwestiwn





12 Tudalen

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plynwch et a'i setlo i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrifft annarllenadwy, neu drefnu iddi! gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgriennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddnt.

6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

17. Os defnyddir mwy nag un llytr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllw'r/gwyllwyr.

8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Arholiad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

[illegible]

(See the other side for English version)

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF:



Complete, fold and seal
(see note 2 below)

England

Concept

Instructions to Candidates

1. Please give the information requested in the boxes below.
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Mark Freed
Esq.

1	Student Number	1702839
2	Title of Examination Paper	Engineering Science
3	Module Code	M4x02192
4	Date and Time of Examination	16/1/19
5	Examination Venue	Uivan Hall
6	Seat Number	G066
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use	
1	8	28
2	4	17
3	9.5	20
4	3.5	10
Total	25	75

Omitting
(Q3b)

$$\frac{24}{70} = 34.$$

33%

1.) $u = 0$
 $v = 100 \text{ km/h} \times \frac{1000}{3600} = 27.77 \text{ m/s} \checkmark$
 $t = 3 \text{ s}$
 $u_2 = 225 \text{ km/h} \times \frac{1000}{3600} = 62.5 \text{ m/s} \checkmark$
 $t_2 = 10 \text{ s}$
 $s = 65 \text{ m}$



a) $v = u + at$
 $v - u = at$
 $\frac{v - u}{t} = a$

$\frac{100 - 0}{3} = a = 33.33 \text{ m/s}^2$

b) $\frac{v - u}{t} = a$

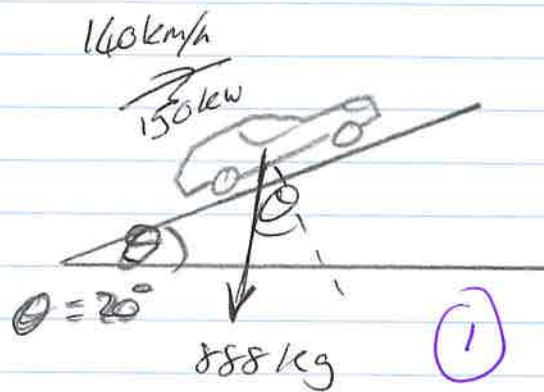
$\frac{225 - 100}{10} = \frac{125}{10} = 12.5 \text{ m/s}^2$

c) $s = ut + \frac{1}{2}at^2$

$t = 62.5 \text{ m/s} \div 75 = 1.78 \text{ sec}$

d) $s = \frac{(u - v)t}{2} = \frac{(100 - 225) 14.78}{2}$
 $= 923.75 \text{ m}$

2.)



$$mg \sin \theta = \text{ } \quad \text{①}$$

~~74~~

$$P = F \times V$$

$$\frac{P}{V} = F \quad \text{①}$$

$$V = 140 \text{ km/h} \times \frac{1000}{3600} = 38.88 \text{ m/s} \quad \text{①}$$

$$P = 150 \text{ kW} / 1500 \text{ W} \quad \times$$

$$\frac{P}{V} = \frac{1500}{38.88} = 38.56 \text{ N} \quad \times \text{①}$$

$$(888 \times 9.81) \sin(20) + 38.56 = 3017.99$$

$$F = mv^2 = 888 \times 38.88^2$$

$$\frac{F_R}{F_N} = \mu \quad \frac{38.88}{3017.99} = 0.013$$

$$\text{Coefficient of friction} = 0 < \mu < 1$$

3. $\omega_1 = 0$

$$\omega_2 = 20,000 \text{ Rpm} \times \frac{2\pi}{60} = 2094.39 \text{ rad/s}$$

$$b = 0.5 \text{ s}$$

$$T = 145 \text{ Nm}$$

a) $I = mk^2$

$$\omega_2 = \omega' + \alpha t$$

$$T = I \alpha$$

$$I = \frac{T}{\alpha} = \frac{145}{4188.78} = \frac{0.034}{28.58}$$

units?

8.5

$$\frac{\omega_2 - \omega_1}{t} = \alpha = \frac{2094.39}{0.5} = 4188.78 \text{ rad/s}^2$$

$$I = 0.034 \text{ Nm}$$

b) $I = mk^2$

$$I = mk^2 \Rightarrow \frac{I}{k^2} = m = \frac{0.03}{2.6^2} =$$

$$T = I \alpha$$

①

$$\frac{T}{\alpha} = I = \frac{145}{2094.39}$$

$$4 \quad \theta = 17.50 \text{ m}$$

$$n = 0.65 \text{ Hz}$$

$$n = \frac{\omega}{2\pi}$$

$$n \times 2\pi = \omega$$

$$0.65 \times 2\pi = 4.08 \text{ units?}$$

$$3.5$$

$$\frac{17.5}{(2\pi)} = 2.78$$

Question No.

Examiner O

Question No.

Examiner On

Arholwr yn unig

llyf y Cwestiwn

Question No.

Examlner On

Arholwr yn unig

liff y Cwestiwn

$$v = u + at$$

$$v^2 = \cancel{\frac{1}{2} u^2} + at$$

3. Rhaid i'r atebion fod mewn llawysgrifen dda gael ei theipio a chael yr ymgeisydd i dalu.

- arholli o dan unrhwy amgylchiadau.

[illegible]