education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

PHYSICAL SCIENCES: PHYSICS P1
FISIESE WETENSKAPPE: FISIKA V1

JUNIE/JUNE 2025

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consists of 17 pages
Hierdie nasienriglyne bestaan uit 17 bladsye

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Please turn over/*Blaai om asseblief*

QUESTION 1 / *VRAAG 1*

1.1	D ✓✓	(2)
1.2	C ✓✓	(2)
1.3	D ✓✓	(2)
1.4	B ✓✓	(2)
1.5	B ✓✓	(2)
1.6	A ✓✓	(2)
1.7	D ✓✓	(2)
1.8	B ✓✓	(2)
1.9	B ✓✓	(2)
1.10	D ✓✓	(2)

[20]

QUESTION 2 / *VRAAG 2*

2.1 **Marking criteria/*Nasienkriteria***

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. */Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the resultant/net force and inversely proportional to the mass of the object. ✓✓

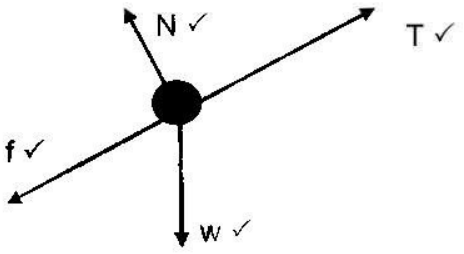
Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die resultante/netto krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/*OF*

The resultant/net force acting on an object is equal to the rate of change of momentum of the object. **(2 or 0)**

Die resulterende/netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering van momentum. ***(2 of 0)*** (2)

2.2



(4)

Accepted labels / Aanvaarde benoemings

w	F_g / F_w / force of earth on block / weight / mg / gravitational force / 11760N
T	Tension / F_T
f	$F_{friction}$ / F_f / frictional force /wrywing
N	Normal force / F_N

Notes/Aantekeninge:

- Mark awarded for label and arrow.
- Any additional forces: deduct 1 mark: max $^3/_4$
- No labels: deduct 1 mark: max $^3/_4$
- If everything correct, but no arrows: deduct 1 mark: $^3/_4$
- Force(s) not touching object: deduct 1 mark: max $^3/_4$
- Ignore relative sizes of the vectors

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2.3 $f = \mu N$ ✓
$= \underline{(0.2)(1200)(9,8)\cos 20^{o}}$ ✓
$= 2\,210,16$ N ✓ (3)

2.4 YES/JA ✓ (1)

2.5 For trailer:
$F_{net} = ma$
$T + (-f) + ((-F_{g||}) = ma$ } Any one/Enige een ✓
$\underline{T - 2210,16}$ ✓ $\underline{- (1200)(9,8)\sin 20^{0}}$ ✓$= \underline{(1\,200)(2,5)}$ ✓
$T - 6232,317 = 3000$
$T = 9\,232,22$N✓
(5)

2.6 **Marking criteria/*Nasienkriteria***
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. */Indien enige van die onderstreepte sleutelwoorde/frases **in die korrekte konteks** uitgelaat is, trek 1 punt af.*
A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net force acts on it.✓✓

'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid volhard, tensy 'n nie-nul resulterende/netto krag daarop inwerk. (2)

2.7 For trailer:
$F_{net} = ma$
$T + (-f) + ((-F_{g||}) = ma$
$\underline{T - 2210,16 - (1200)(9,8)\sin 20^{0}}$ ✓$= \underline{0}$ ✓
$T - 6232,317 = 0$
$T = 6232,32$ N

For bakkie:
$F_{net} = ma$
$F + (-f) + ((-F_{g||}) + (-T) = ma$
$\underline{F - (0,3)(2700)(9,8)\cos 20^{0}}$ ✓ $\underline{- (2700)(9,8)\sin 20^{0}}$ ✓ $- 6232,32 = 0$
$F - 7459,28 - 9049,85 - 6232,32 = 0$
$F = 22\,741,45$ N✓
(5)
[22]

QUESTION 3 / VRAAG 3

3.1 $9,8\ m{\cdot}s^{-2}$ ✓ downwards/afwaarts ✓ (2)

3.2 Free fall is the motion during which the only force acting on an object is the gravitational force.. ✓ ✓ **(2 or 0)**

Vryval is die beweging waartydens die enigste krag wat op 'n voorwerp inwerk, die gravitasiekrag is. **(2 or 0)**

(2)

3.3.1

OPTION 1/OPSIE 1	
Upwards positive/Opwaarts positief	**Downwards positive/Afwaarts positief**
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = \underline{(0)^2 + 2(-9,8)(-92,4)}$ ✓ $v_f = 42.56\ m{\cdot}s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ $v_f^2 = \underline{(0)^2 + 2(9,8)(92,4)}$ $v_f = 42.56\ m{\cdot}s^{-1}$

(3)

3.3.2

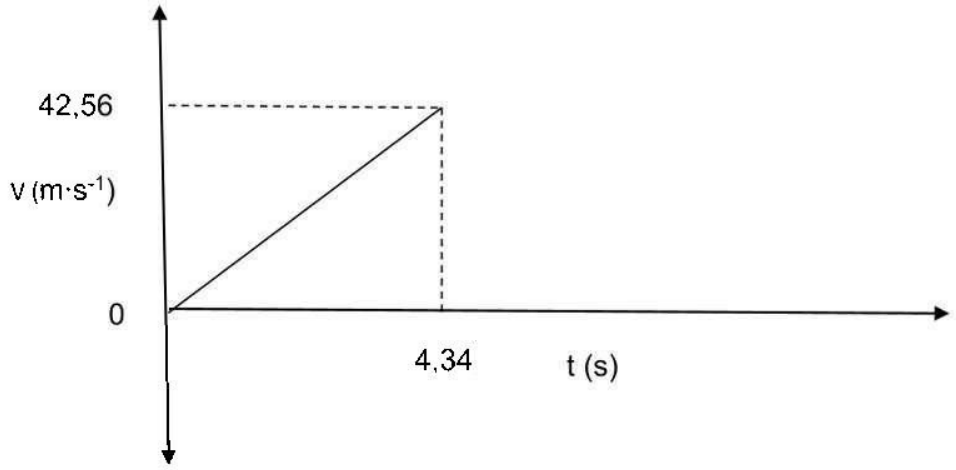
POSITIVE MARKING FROM Q3.2 **POSITIEWE MERK VANAF Q3.2**
OPTION 1/OPSIE 1 **Upwards positive/Opwaarts positief** $v_f = v_i + a\Delta t$ ✓ $-42,56 = 0 + (-9,8)\Delta t$ ✓ $\Delta t = 4,34\ s$ ✓ **Downwards positive/Afwaarts positief** $v_f = v_i + a\Delta t$ $42,56 = 0 + (9,8)\Delta t$ $\Delta t = 4,34\ s$
OPTION 2/OPSIE 2 **Upwards positive/Opwaarts positief** $\Delta x = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓ $-92,4 = 0\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓ $\Delta t = 4,34\ s$ ✓ **Downwards positive/Afwaarts positief** $\Delta x = v_i\Delta t + \frac{1}{2} a\Delta t^2$ $92,4 = 0\Delta t + \frac{1}{2}(9,8)\Delta t^2$ $\Delta t = 4,34\ s$

(3)

3.4

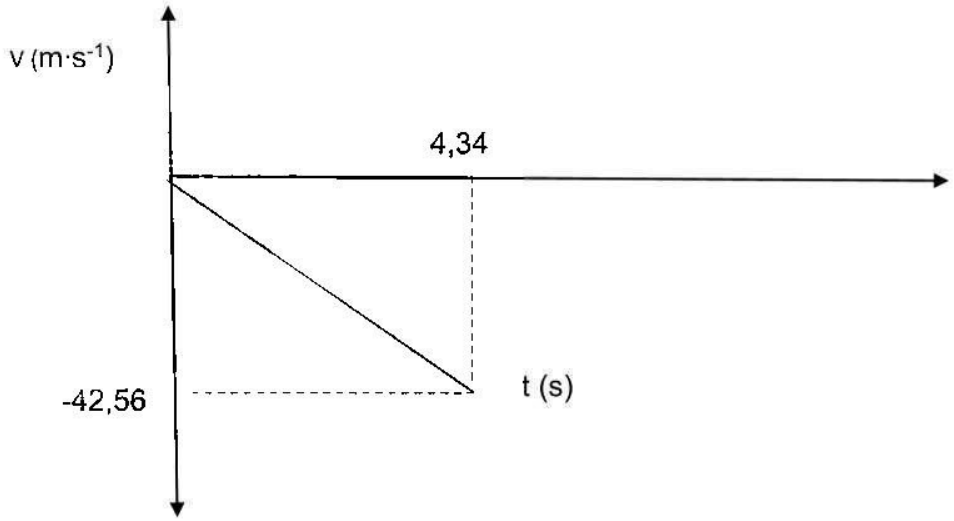
POSITIVE MARKING FROM Q3.2 & 3.3 **POSITIEWE MERK VANAF Q3.2 & 3.3**

Downwards positive/Afwaarts positief



Marking **criteria** for **graph** **Nasienriglyne vir grafiek**	**Mark** **Punt**
Correct **shape of** graph Korrekte **vorm van** grafiek	✓
Final velocity Eindsnelheid	✓
Time at which it reaches the ground Tyd wat dit neem om die grond te tref	✓

Upwards positive/Opwaarts positief



(3)

3.5 Same/Dieselfde ✓
Mass has no influence/Gravitational acceleration is the same/it is in a free fall ✓
Massa het geen invloed nie/Gravitasie versnelling is dieselfde/dit is in vryval (2)
[15]

QUESTION 4 / VRAAG 4

4.1 Impulse is the product of the resultant/net force acting on an object and the time the net force acts on the object. ✓✓ **(2 or 0)**

Impuls is die produk van die resulterende/netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.. **(2 of 0)** (2)

4.2 $F_{net} \cdot \Delta t = \Delta p$
$F_{net} \cdot \Delta t = mv_f - mv_i$ } ✓ Any one/enige een
Impulse $= mv_f - mv_i$
$= (0,15)(3,65) - (0,15)(-6,5)$ ✓
$= 1,52$ kg· m·s^{-1}/N·s ✓ (3)

4.3 $E_{MTOP} = E_{MBOTTOM}$
$E_{KTOP} + E_{PTOP} = E_{KBOTTOM} + E_{PBOTTOM}$ } ✓ Any one/enige een
$\frac{1}{2}mv^2 + mgh = \frac{1}{2}mv^2 + mgh$
$0 + (0,15)(9,8)h$ ✓ $= \frac{1}{2}(0,15)(6,5)^2$ ✓ $+ 0$
$h = 2,16$ m
Initial height dropped from is 2,16 m.

$\frac{1}{3}h = \frac{1}{3} \times 2,16$ ✓ $= 0,72$ m

The ball does not meet minimum requirements✓ because it only reached 0,65 m. (5)

[10]

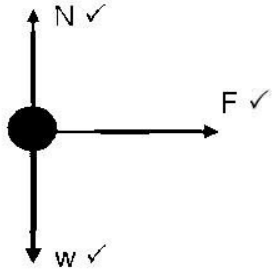
QUESTION 5 / VRAAG 5

5.1

Marking criteria/*Nasienkriteria*
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. */Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*
The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system remains constant.✓✓ Die totale meganiese energie (som van gravitasie- potensiële energie en kinetiese energie) in 'n geslote sisteem bly konstant.

(2)

5.2



(3)

Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / mg / gravitational force /2450 N
F	Applied force / Force of trolley A on trolley B
N	Normal force / F_N

Notes/Aantekeninge:
- Mark awarded for label and arrow.
- Any additional forces: deduct 1 mark: max $^2/_3$
- No labels: deduct 1 mark: max $^2/_3$
- If everything correct, but no arrows: deduct 1 mark: $^2/_3$
- Force(s) not touching object: deduct 1 mark: max $^2/_3$
- Ignore relative sizes of the vectors

5.3

$E_{MTOP} = E_{MBOTTOM}$
$E_{KTOP} + E_{PTOP} = E_{KBOTTOM} + E_{PBOTTOM}$ } ✓ Any one/enige een
$\frac{1}{2}mv^2 + mgh = \frac{1}{2}mv^2 + mgh$
$0 + \underline{(300)(9,8)(30)}$ ✓ $= \underline{\frac{1}{2}(300)v^2}$ ✓ $+ 0$
$v = 24,25\ m \cdot s^{-1}$ ✓

(4)

5.4

POSITIVE MARKING FROM Q5.3 **POSITIEWE MERK VANAF Q5.3**
TAKE TO THE RIGHT AS POSITIVE/NEEM REGS AS POSITIEF

(5)

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$\Sigma p_i = \Sigma p_f$ $(mv_i)_A + (mv_i)_B = (mv_f)_1 + (mv_f)_2$ ✓ Any one/enige een $\underline{(300)(24,25)}$ ✓ + 0 = $\underline{(300 + 250)v_f}$ ✓ $v_f = 13,23\ m{\cdot}s^{-1}$ ✓ to the right/na regs ✓

5.5

POSITIVE MARKING FROM Q5.3 & Q5.4 **POSITIEWE MERK VANAF Q5.3 & Q5.4**
$W_{net} = \Delta Ek$ $f\Delta x\cos\Theta + fg_{//}\Delta x\cos\Theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ } Any one ✓ $\underline{(10)\ \Delta x\cos 180°}$ ✓ + $\underline{(550)(9,8)\sin 30^0\ \Delta x\cos 180^0}$ ✓ = 0 – $\underline{[\frac{1}{2}(550)(13,23)^2]}$ ✓ $\underline{\Delta x} = 17,79$ m ✓

(5)
[19]

QUESTION 6 / VRAAG 6

6.1.1 Doppler effect as the change in frequency (or pitch) of the sound detected by a listener, because the sound source and the listener have different velocities relative to the medium of sound propagation.✓✓ **(2 or 0)**

Doppler-effek neer as die verandering in frekwensie (of toonhoogte) van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het. **(2 of 0)** (2)

6.1.2 Higher than ✓
Hoër as (1)

6.1.3

$$f_L = \frac{v \pm v_L}{v \pm v_S} f_S \checkmark \quad \text{OR} \quad f_L = \frac{v}{v - v_S} f_S$$

$$f_L = \frac{335 + 0}{335 - 20} \checkmark \quad 850 \checkmark$$

$$f_L = 903{,}97 \text{ Hz} \checkmark$$

(5)

6.1.4

$v = \frac{d}{t}$ ✓ Accept : $v = \frac{\Delta x}{\Delta t}$

$20 = \frac{d}{3}$ ✓

d = 60 m ✓ (3)

6.2.1 Y ✓✓ (2)

6.2.2 Away from the Earth/Weg van die Aarde ✓✓ (2)
[15]

QUESTION 7 / VRAAG 7

7.1 **Marking criteria/*Nasienkriteria***

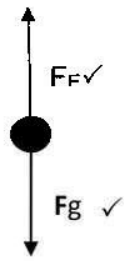
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. */Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

Note: If **masses** used ($^0/_2$)

The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance (r) between them ✓

Die grootte van die elektrostatiese krag wat een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. (2)

7.2



Accepted labels / Aanvaarde benoemings	
F_E	Electrostatic force between charges **X** and **Y**
	Elektrostatiese krag tussen ladings **X** en **Y**
F_g	Gravitational force on **X**
	Gravitasiekrag op **X**

(2)

Notes/Aantekeninge:

- Any additional forces: deduct 1 mark: max $^1/_2$
- No labels: deduct 1 mark: max $^1/_2$
- No arrows: $0/2$
- Force(s) not touching object: deduct 1 mark: max $^1/_2$
- Ignore relative sizes of the vectors

7.3

$F_g = mg$ $\qquad F = \frac{kQ_1Q_2}{r^2}$ ✓ (6)

$= (40 \times 10^{-3})(9,8)$ ✓

$= 0,392$ N

$F_g = F_E$

$0,392 = \frac{(9\times10^9)q^2}{(0,3)^2}$ ✓

$= \frac{(9\times10^9)\ q^2}{(0,3)^2}$ ✓

$q = 2 \times 10^{-6}$ C ✓

Charge on **Y** original = 4×10^{-6} C ✓

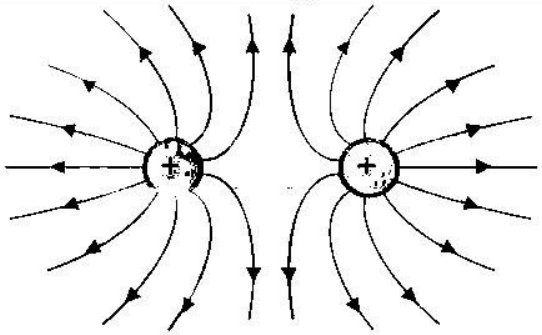
[10]

QUESTION 8 / VRAAG 8

8.1 The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point.✓✓ **(2 or 0)**

Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is, ondervind word. ***(2 or 0)*** (2)

8.2



Criteria for sketch/Kriteria vir skets	Marks/Punte
Correct shape as shown. Korrekte vorm soos getoon.	✓
Direction away from positive to negative. Rigting weg van positief na negatief.	✓
Field lines start on spheres and do not cross for correct diagram. Veldlyne begin op elke sfeer en kruis nie vir korrekte diagram.	✓

(3)

8.3 Added / Bygevoeg ✓

(1)

8.4.1

$$n = \frac{Q}{e} \checkmark$$

$$n = \frac{-4 \times 10^{-9}}{-1{,}6 \times 10^{-19}} \checkmark$$

= 2,5 x 10^{13} electrons/elektrone ✓ (3)

8.4.2 **Marking criteria/Merk kriteria**

- Mark for correct formula to calculate E
- Mark for substituting into formula for charge A
- Mark for substituting into formula for charge C

- Mark for correct use of positive and negative signs
- Mark for the final answer
- Mark for correct direction

$E = \frac{kQ}{r^2}$ ✓

$E_{net} = E_A + E_B + E_C$

$= \frac{(9 \times 10^9)(1 \times 10^{-6})}{(0{,}016)^2}$ ✓ $+ \frac{(9 \times 10^9)(2{,}5 \times 10^{-6})}{(0{,}014)^2}$ ✓ $- \frac{(9 \times 10^9)(4 \times 10^{-6})}{(0{,}01)^2}$ ✓

E_{net} = 2, 098 x 10^8 $N.C^{-1}$ ✓ left ✓ (6)

[15]

QUESTION 9 / VRAAG 9

9.1 The maximum energy provided by a battery per unit charge passing through it. ✓✓
(2 or 0) (2)

Die maksimum energie wat 'n battery lewer per eenheidslading wat daardeur vloei. **(2 of 0)**

9.2

$$\frac{1}{R\|} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} \checkmark$$
$$= \frac{1}{5} + \frac{1}{10} + \frac{1}{20} \checkmark$$

R = 2,86 Ω ✓ (3)

9.3

OPTION 1/OPSIE 1
Diagram B

- The total resistance of the circuit increases✓
- Total current decreases✓
- The Vint decreases✓
- therefore Vext increases

OPTION 2/OPSIE 2
Diagram A

- The total resistance of the circuit decreases✓
- Total current increases✓
- The Vint increases✓
- therefore Vext decreases

(3)

9.4.1

POSITIVE MARKING FROM Q9.2
POSITIEWE MERK VANAF Q9.2

$R = \frac{V}{I}$ ✓

$2,86 = \frac{10}{I}$ ✓

I = 3,50 A ✓

(3)

9.4.2

POSITIVE MARKING FROM Q9.2 & 9.4.1
POSITIEWE MERK VANAF Q9.2 & 9.4.1

Diagram A

$\varepsilon = I(R + r)$ ✓

$\varepsilon = \underline{3,5\ (2,86 + r)}$ ✓.....1

Diagram B

$R = \frac{V}{I}$

$I = \frac{12}{5.5} = 2,18$ A

$\varepsilon = I(R + r)$

$\varepsilon = \underline{2,18\ (5,5 + r)}$ ✓.....2

Equation 1 = Equation 2 ✓

$3,5\ (2,86 + r) = 2,18(5,5 + r)$

$r = 1,5\ \Omega$ ✓

(5)

9.4.3 **POSITIVE MARKING FROM Q9.2 & 9.4.1 & 9.4.2**
POSITIEWE MERK VANAF Q9.2 & 9.4.1 & 9.4.2

$\varepsilon = I(R + r)$
$= 3,5\ (2,86 + 1,5)$ ✓
$= 15,26$ V ✓

OR

$\varepsilon = I(R + r)$
$= 2,18\ (5,5 + 1,5)$ ✓
$= 15,26$ V ✓

(2)

9.4.4

POSITIVE MARKING FROM Q9.2 & 9.4.1 & 9.4.2 & 9.4.3 **POSITIEWE MERK VANAF Q9.2 & 9.4.1 & 9.4.2 & 9.4.3**
OPTION 1/OPSIE 1 $P = I^2R$ ✓ $= (2,18)^2 \quad (5,5)$✓ $= 26,14$ W✓
OPTION 2/OPSIE 2 $P = \frac{V^2}{R}$✓ $P = \frac{12^2}{5,5}$✓ $P = 26,18W$✓
OPTION 3/OPSIE 3 $P = VI$ ✓ $= (12)\ (2,18)$✓ $= 26,16$ W✓

(3)

9.5

- The voltmeter **reading** INCREASES. ✓
- Total resistance increases and total current decreases, ✓
- Vint decreases ✓

- Die voltmeterlesing NEEM TOE
- Totale weerstand neem toe en totale stroom neem af
- Vint neem af

(3)

[24]

TOTAL/*TOTAAL* **150**

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