



education

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**NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

**PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (V1)**

SEPTEMBER 2022

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/ PUNTE: 150

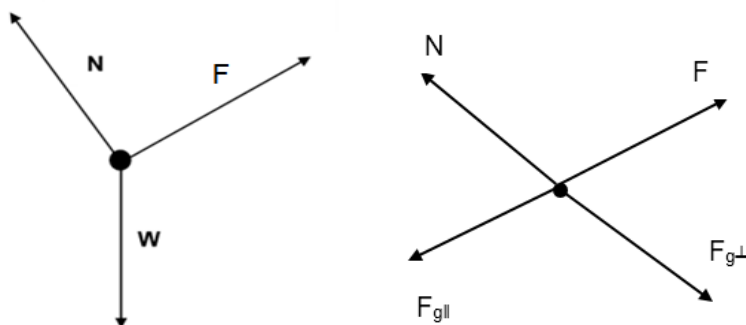
**These marking guidelines consist of 16 pages including the cognitive table/
Hierdie nasienriglyne bestaan uit 16 bladsye wat die kognitiewe tabel insluit.**

QUESTION 1/VRAAG 1

1.1	C	✓✓	(2)
1.2	D	✓✓	(2)
1.3	A	✓✓	(2)
1.4	D	✓✓	(2)
1.5	B	✓✓	(2)
1.6	C	✓✓	(2)
1.7	D	✓✓	(2)
1.8	A	✓✓	(2)
1.9	C	✓✓	(2)
1.10	B	✓✓	(2)
			[20]

QUESTION 2 /VRAAG 2

2.1

**Accept the following symbols**

N ✓	F_N /Normal/Normal force <i>Normaal/Normaalkrag</i>
F ✓	F_A /Applied force force/ 5000 N <i>F_A/Toegepaste krag/ 5000 N</i>
w ✓ OR $F_{g\parallel}$ and $F_{g\perp}$	F_g /mg/weight/ gravitational force <i>F_g/mg/gewig/ gravitasiekrag</i>

(3)

2.2 $F_{g\parallel} = w \sin \theta$ ✓

$5000 = w \sin 15^\circ$ ✓

$w = 19318,52 \text{ N}$

$M_E = \frac{(19318,52)}{9,8} - 800$ ✓

$= 1171,28 \text{ kg}$ ✓

(4)

2.3.1 Increases/Verhoog. ✓

(1)

2.3.2 Crate is moving at constant acceleration/Die krat beweeg teen 'n konstante versnelling ✓

(1)

2.4.1 The force or the component of a force which a surface exerts on an object with which it is in contact, and which is perpendicular to the surface.
/Die krag of die komponent van die krag wat 'n voorwerp op 'n oppervlakte uitoefen waarmee dit in kontak is, en wat loodreg op die oppervlakte is. ✓✓
(2 or/of 0)

(2)

$$\begin{aligned}2.4.2 \quad F_{g\parallel} &= w \sin\theta \\ &= (98) (\sin\theta) \\ F_{g\perp} &= w \cos\theta \\ &= (98) (\cos\theta) \\ 7 F_{g\parallel} &= 4 F_{g\perp} \checkmark \\ 7 (98) (\sin\theta) &= 4 (98) (\cos\theta) \checkmark \\ \tan\theta &= 0,5714 \\ \theta &= 25,53^\circ \checkmark\end{aligned}$$

Note: By using $\tan\theta$ - 2/3 marks

Nota: Gebruik van $\tan\theta$ - 2/3 punte

$$\tan\theta = \frac{4}{7} \checkmark$$

$$\theta = 25,53^\circ \checkmark$$

(3)

[14]

QUESTION 3/ VRAAG 3

3.1 Motion during which the only force acting on an object is the force of gravity.
Beweging waar die enigste krag wat op die voorwerp inwerk gravitasiekrag is. ✓✓ **(2 or/of 0)** (2)

3.2.1 1,4 s ✓ (1)

3.2.2 $9,8 \text{ m} \cdot \text{s}^{-2}$ ✓ downwards ✓ / afwaarts ✓ (2)

3.2.3 $1,4 + 0,8 = 2,2 \text{ s}$ ✓✓ (2)

3.3.1 $v_f = v_i + a\Delta t$ ✓
 $0 = v_i + (-9,8)(1,4)$ ✓
 $v_i = 13,72 \text{ m} \cdot \text{s}^{-1}$ ✓ (3)

3.3.2 **POSITIVE MARKING FROM QUESTION 3.3.1 and 3.2.3/**
POSITIEWE NASIEN VANAF 3.3.1 and 3.2.3

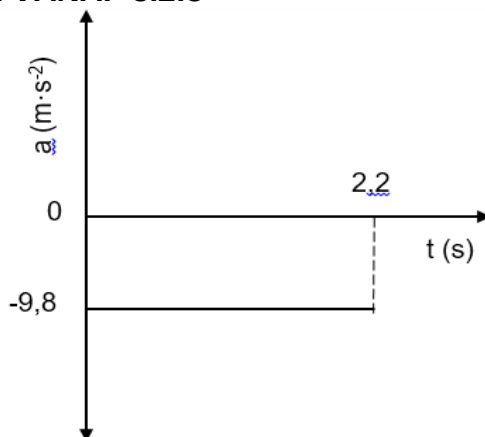
$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$\Delta y = (13,72)(2,2) + \frac{1}{2} (-9,8)(2,2^2) \quad \checkmark$$

$$= 6,47 \text{ m} \quad \checkmark$$

(3)

3.4 **POSITIVE MARKING FROM QUESTION 3.2.3**
POSITIEWE NASIEN VANAF 3.2.3

**Marking Criteria**

- Labelling -9,8 and 2,2 on the graph ✓
- Shape and graph lies below x axis ✓

Nasien kriteria

- Toon -9,8 en 2,2 op die grafiek ✓
- Vorm van grafiek en grafiek lê onder die x-as ✓

(2)

3.5 Change in the velocity ✓
Verandering in die snelheid ✓

(1)

[16]

QUESTION 4 / VRAAG 4

- 4.1 The net force acting on an object is equal to rate of change of momentum of the object ✓✓

Die netto krag wat op 'n voorwerp inwerk is gelyk aan die verandering in die momentum van die voorwerp ✓✓

(2 or/lof 0)

(2)

- 4.2 $F_{\text{net}} \Delta t = \Delta P$ ✓
 $(-1,2)(\Delta t) = (-0,24)$ ✓
 $\Delta t = 0,2 \text{ s}$ ✓

(3)

- 4.3 **OPTION 1**

$$F_{\text{net}} \Delta t = \Delta P = m(v_f - v_i) \checkmark$$

$$(-1,2)(0,2) = 0,6(v_f - 0,5) \checkmark$$

$$v_f = 0,1 \text{ m} \cdot \text{s}^{-1} \text{ towards east } \checkmark$$

- OPTION 2**

$$\Delta P = m(v_f - v_i) \checkmark$$

$$(-0,24) = 0,6(v_f - 0,5) \checkmark$$

$$v_f = 0,1 \text{ m} \cdot \text{s}^{-1} \text{ towards east } \checkmark$$

(3)

- 4.4 $E_{\text{kbefore}} = E_{\text{kafter}}$ } any one / enige een ✓
 $E_k = \frac{1}{2} mv^2$ }
 $0,042 = \frac{1}{2} (0,8)(v_f)^2 \checkmark$
 $v_f = 0,32 \text{ m} \cdot \text{s}^{-1} \checkmark$

(3)

[11]

QUESTION 5 / VRAAG 5

- 5.1 The net/total work done on an object is equal to the change in the object's kinetic energy. ✓✓

/ Die netto werk verrig op 'n voorwerp is gelyk aan sy verandering in kinetiese energie.

OR

The work done on an object by a resultant/net force is equal to the change in the objects kinetic energy. ✓✓

/ Die werk verrig op 'n voorwerp deur 'n netto/resultante krag is gelyk aan sy verandering in kinetiese energie.

(2)

- 5.2 $W_{nc} = \Delta E_K + \Delta E_p$ } any one / enige een ✓

$$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{pf} - E_{pi})$$

$$0 \checkmark = (E_{Kf} - 0) + (0 - (75)(9,8)(25)) \checkmark$$

$$E_{Kf} = 18375 \text{ J } \checkmark$$

(4)

- 5.3 **POSITIVE MARKING FROM QUESTION 5.2**

POSITIEWE NASIEN VANAF 5.2

$$W_{nc} = \Delta E_K + \Delta E_p$$

$$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{pf} - E_{pi})$$

$$= (0 - 18375) \checkmark + (0 - (75)(9,8)(20)) \checkmark$$

$$= (-18375) + (-14700)$$

$$= -33075 \text{ J } \checkmark$$

(3)

- 5.4 33075 J ✓

(1)

- 5.5 **POSITIVE MARKING FROM QUESTION 5.3**

POSITIEWE NASIEN VANAF 5.3

$$W_{nc} = F \Delta x \cos \theta \checkmark$$

$$-33075 \checkmark = F_T \times 20 \cos 180^\circ \checkmark$$

$$F_T = 1653,75 \text{ N } \checkmark$$

(4)

[14]

QUESTION 6 / VRAAG 6

- 6.1 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. / Die verandering in die frekwensie (toonhoogte) van die waargenome klank deur die luisteraar agv die klankbron en die luisteraar wat verskillende snelhede relatief tot mekaar het.

OR/OF

An (apparent) change in (observed/detected) frequency (pitch), ✓ as a result of the relative motion between a source and an observer ✓ (listener).

'n (Skynbare) verandering in (waargenome) frekwensie ✓ (toonhoogte), as gevolg van die relatiewe beweging tussen die bron en 'n waarnemer/luisteraar. ✓

(2)

6.2

OPTION 1

$$f_{\text{(recorded)}} = \frac{(4)}{(1 \times 10^{-4})} \checkmark$$

$$= 40000 \text{ Hz}$$

$$= 40 \text{ kHz}$$

$$40 - 38 = 2 \text{ kHz} \checkmark$$

OPTION 2

$$f_{\text{(recorded)}} = \frac{(2)}{(5 \times 10^{-5})} \checkmark$$

$$= 40000 \text{ Hz}$$

$$= 40 \text{ kHz}$$

$$40 - 38 = 2 \text{ kHz} \checkmark$$

(2)

- 6.3 When the dolphin is moving towards the recorder, there is a compression of the wave fronts, ✓ more waves are arriving per second. ✓
Wanneer die dolfyn na die klankopnemer beweeg vind 'n kompressie van golf fronte plaas ✓ en meer golwe arriveer per sekonde ✓

(2)

6.4 OPTION 1 / OPSIE 1

$$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$$

$$40000 \checkmark = \frac{(1500 + 0)}{(1500 - v_s)} 38000 \checkmark$$

$$v_s = 71,43 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)

- 6.5 The light coming from the distant planet observed from the Earth has a lower frequency and therefore a longer wavelength. ✓
Therefore it is shifted towards the red end of the spectrum. ✓
Die lig vanaf verafgeleë planete wat observeer word van die aarde het 'n laer frekwensie en langer golflengte ✓, daarom vind 'n verskuiwing na die rooi gedeelte van die speltrum plaas ✓

(2)

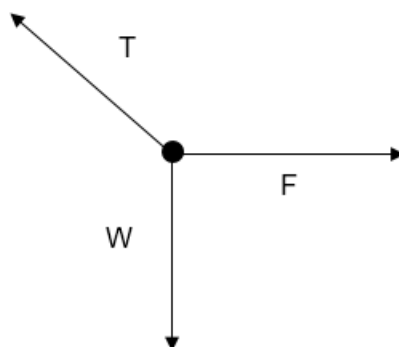
[13]

QUESTION 7 / VRAAG 7

- 7.1 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 their charges ✓ and inversely proportional to the square of the distance (r) between them ✓
 / Die grootte van die elektrostatische krag wat deur een puntlading (Q_1) op 'n ander puntlading (Q_2) uitgeoefen word, 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



Accept the following symbols	
T ✓	Tension in the spring / Spanning in die tou
F ✓	Electrostatic force of repulsion / Elektrostatische afstotingskrag
w ✓	F_g /mg/weight/ $F_{\text{earth on sphere}}$ /gravitational force F_g /mg/gewig/ $F_{\text{aarde op sfeer}}$ /gravitasiekrag force

(3)

- 7.3.1 Forces are in equilibrium / Kragte is in ewewig

$$w = mg$$

$$= (0,0009)(9,8) \quad \checkmark$$

$$= 0,0088 \text{ N}$$

$$\tan 45^\circ = \frac{(F)}{(0,0088)} \quad \checkmark$$

$$(0,0088)$$

$$= 0,008 \text{ N repulsion to the right. / afstotend na regs} \quad \checkmark$$

(3)

7.3.2 **POSITIVE MARKING FROM QUESTION 7.1.3**
POSITIEWE NASIEN VANAF 7.1.3

$$F = \frac{kQ_1Q_2}{r^2} \quad \checkmark$$

$$0,0088 = \frac{(9 \times 10^9) (Q)^2}{(0,04)^2} \quad \checkmark$$

$$Q = 3,8 \times 10^{-8} \text{ C} \quad \checkmark \text{ Accept the range } 3,8 \text{ to } 3,9 \times 10^{-8} \text{ C}$$

$$Q = 3,8 \times 10^{-8} \text{ C} \quad \checkmark \text{ Aanvaar omvang } 3,8 \text{ tot } 3,9 \times 10^{-8} \text{ C} \quad (3)$$

7.4.1

$$F = \frac{kQ_1Q_2}{r^2}$$

'F' at 'C' due to A

$$F_{CA} = \frac{(9,0 \times 10^9) (4 \times 10^{-6}) (8 \times 10^{-6})}{0,5^2} \quad \checkmark$$

$$= 1,152 \text{ N to the right / na regs}$$

'F' at 'C' due to B

$$F_{CB} = \frac{(9,0 \times 10^9) (4 \times 10^{-6}) (3 \times 10^{-6})}{0,2^2} \quad \checkmark$$

$$= 2,7 \text{ N to the left / na links}$$

$$\text{Net electrostatic force at C} = 1,152 - 2,7 = - 1,548 \text{ N to the left} \quad \checkmark$$

$$\text{Netto elektrostatiesekrag by C} = 1,152 - 2,7 = - 1,548 \text{ N na links} \quad \checkmark \quad (3)$$

[14]

QUESTION 8 / VRAAG 8

8.1 Internal resistance is the *resistance found inside the battery due to the movement of charges.* ✓✓

Interne weerstand is die weerstand in die battery as gevolg van die beweging van lading (2)

8.2 $V_2 = 2V_3$ ✓

OR

$V_3 = \frac{1}{2} V_2$

(1)

8.3 $V_1 = V_2 + V_3$

$21 = V_2 + \frac{1}{2} V_2$

$V_2 = 14 \text{ V}$ ✓

$V_3 = 7 \text{ V}$ ✓

(2)

8.4.1 $V_{\text{lost}} = 24 - 21$

$= 3 \text{ V}$ ✓

$V_{\text{lost}} = I_r$ ✓

$3 = 3r$ ✓

$r = 1 \Omega$ ✓

(4)

8.4.2

OPTION 1

$R = \frac{V}{I}$ ✓

$V_2 = 14 \text{ V}$

$14 = 3R$ ✓

$R = 4,67 \Omega$ ✓

OPTION 2

$R = \frac{V}{I}$ ✓

$V_3 = 7 \text{ V}$

$7 = 3R_T$

$7 = \frac{(3)(R)}{2}$ ✓

$R = 4,67 \Omega$ ✓

(3)

8.5 $P = VI$

$60 = 12 \times I$ ✓

$I = 5 \text{ A}$

$Q = It$ ✓

$= 5 \times 2 \times 60$ ✓

$= 600 \text{ C}$ ✓

(4)

[16]

QUESTION 9 / VRAAG 9

9.1.1 Slip rings✓ / Sleepringe (1)

9.1.2 Slip rings keep the armature in contact with the brushes, and thus ensure flow of current to the external circuit. ✓✓
Sleepringe hou die spoel in kontak met die koolstofborsels en verseker die vloeï van stroom na die eksterne stroombaan ✓✓ (2)

9.2 Induction of an electromotive force by the motion of conductor across a magnetic field.
 OR
 Whenever there is a change in the magnetic flux linkage with a conductor an emf is induced. ✓✓
Induksie van 'n elektromotoriese krag deur die beweging van 'n geleier oor 'n magnetiese veld.
 OF
Wanneer daar 'n verandering in die magnetiese vloedkoppeling is met 'n geleier waarin 'n emk dan geïnduseer word (2)

9.3 A to B / A na B✓ (1)

9.4 Remains the same ✓ Bly dieselfde ✓ (1)

9.5 Coil will be parallel to the field✓✓ / Spoel sal parallel aan die veld wees (2)

9.6.1 $V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}}$ ✓
 $V_{\text{rms}} = \frac{17}{\sqrt{2}}$ ✓
 $V_{\text{rms}} = 12,02 \text{ V}$ ✓
 $V_{\text{wgk}} = \frac{V_{\text{max}}}{\sqrt{2}}$
 $V_{\text{wgk}} = \frac{17}{\sqrt{2}}$
 $V_{\text{wgk}} = 12,02 \text{ V}$ (3)

9.6.2 POSITIVE MARKING FROM QUESTION 9.2.1

$$P_{\text{ave}} = I_{\text{rms}} \times V_{\text{rms}} \checkmark$$

$$15 = I_{\text{rms}} \times 12,02 \checkmark$$

$$I_{\text{rms}} = 1,25 \text{ A}$$

$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}} \checkmark$$

$$1,25 = \frac{I_{\text{max}}}{\sqrt{2}} \checkmark$$

$$I_{\text{max}} = 1,77 \text{ A} \checkmark$$

POSITIEWE NASIEN VANAF VRAAG 9.2.1

$$P_{\text{gem}} = I_{\text{wgk}} \times V_{\text{wgk}} \checkmark$$

$$15 = I_{\text{wgk}} \times 12,02 \checkmark$$

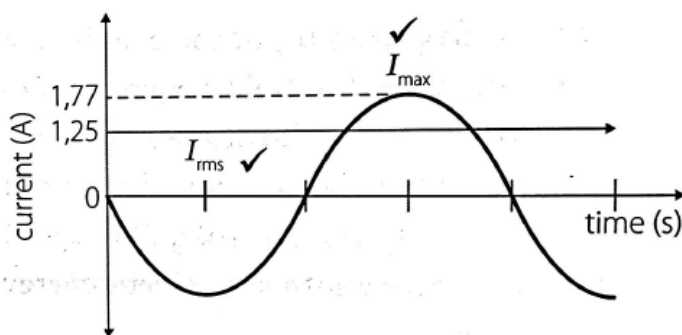
$$I_{\text{wgk}} = 1,25 \text{ A}$$

$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}} \checkmark$$

$$1,25 = \frac{I_{\text{max}}}{\sqrt{2}} \checkmark$$

$$I_{\text{maks}} = 1,77 \text{ A} \checkmark$$

(5)

**9.6.3 POSITIVE MARKING FROM QUESTION 9.2.2
POSITIEWE NASIEN VANAF VRAAG 9.2.2****Marking Criteria / Nasien kriteria**

- Labelling I_{max} on the graph / I_{maks} aangedui op die grafiek ✓
- Labelling I_{rms} on the graph / I_{wgk} aangedui op die grafiek ✓

(2)
[19]

QUESTION 10 / VRAAG 10

10.1 Threshold frequency / *Drumpelfrekwensie* ✓ (1)

10.2 $E = W_0 + E_{k(max)}$ } any one / enige een ✓
 $E = hf_0 + \frac{1}{2} mv^2$ }
 $(6,63 \times 10^{-34}) (5 \times 10^{15}) \checkmark = (6,63 \times 10^{-34}) (f_0) \checkmark + (\frac{1}{2} \times 9,1 \times 10^{-31})(5 \times 10^5)^2 \checkmark$
 $f_0 = 4,8 \times 10^{15} \text{ Hz} \checkmark$ (5)

10.3.1 The work function of a metal is the minimum energy that an electron needs to be emitted from the metal surface ✓✓
Die werksfunksie van 'n metaal is die minimum hoeveelheid energie benodig om elektrone uit die oppervlakte van die metaal vry te stel
(2 or/of 0) (2)

10.3.2 $W_0 = hf_0 \checkmark$
 $9,44 \times 10^{-19} = (6,63 \times 10^{-34}) (f_0) \checkmark$
 $f_0 = 1,42 \times 10^{15} \text{ Hz} \checkmark$ (3)

10.3.3 The frequency of blue light is less than that of threshold frequency of selenium, ✓ and the frequency of ultraviolet light (found in day light) is greater than threshold frequency of selenium. ✓
Die frekwensie van blou lig is laer as die drumpelfrekwensie van selenium, ✓ en die frekwensie van ultraviolet lig (wat in die dag gekry word) is groter as die drumpelfrekwensie van selenium. ✓ (2)
[13]

TOTAL/TOTAAL: 150

SUBJECT: PHYSICAL SCIENCES PAPER 1											GRADE 12		
ANALYSIS GRID											SEPTEMBER 2022		
QUESTION	Mark	Cognitive Levels				Topics				TOTAL	Difficulty Levels		
		1	2	3	4	Mechanics ≈ 65 Marks	Waves, Sound & Light ≈ 15 Marks	Electricity & Magnetism ≈ 55 Marks	Matter & Materials ≈ 15 Marks		Easy	Moderate	Difficult
1.1	2	2				2				2	2		
1.2	2			2		2				2	2		
1.3	2			2		2				2	2		
1.4	2		2			2				2		2	
1.5	2		2			2				2	2		
1.6	2	2					2			2		2	
1.7	2			2				2		2			2
1.8	2				2			2		2			2
1.9	2			2				2		2	2		
1.10	2	2							2	2		2	
Ques 1	20	6	4	8	2	10	2	6	2	20	10	6	4
2.1	3		3			3				3	3		
2.2	4				4	4				4			4
2.3.1	1			1		1				1		1	
2.3.2	1			1		1				1		1	
2.4.1	2	2				2				2	2		
2.4.2	3				3	3				3			3
Ques 2	14	2	3	2	7	14	0	0	0	14	5	2	7
3.1	2	2				2				2	2		
3.2.1	1		1			1				1	1		
3.2.2	2		2			2				2		2	
3.2.3	2			2		2				2			2
3.3.1	3		3			3				3		3	
3.3.2	3			3		3				3		3	
3.4	2		2			2				2		2	
3.5	1			1		1				1			1
Ques 3	16	2	8	6	0	16	0	0	0	16	3	10	3
4.1	2	2				2				2	2		
4.2	3		3			3				3		3	
4.3	3		3			3				3		3	
4.4	3			3		3				3		3	
Ques 4	11	2	6	3	0	11	0	0	0	11	2	9	0
5.1	2	2				2				2	2		
5.2	4		4			4				4		4	
5.3	3			3		3				3			3
5.4	1		1			1				1		1	
5.5	4			4		4				4			4
Ques 5	14	2	5	7	0	14	0	0	0	14	2	5	7
6.1	2	2					2			2	2		
6.2	2			2			2			2			2
6.3	2		2				2			2		2	
6.4	5		5				5			5		5	
6.5	2			2			2			2	2		
Ques 6	13	2	7	4	0	0	13	0	0	13	4	7	2
7.1	2	2						2		2	2		
7.2	3			3				3		3		3	
7.3.1	3			3				3		3			3
7.3.2	3		3					3		3		3	

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7.4.1	3				3			3		3		3	
Ques 7	14	2	3	6	3	0	0	14	0	14	2	9	3
8.1	2	2						2		2	2		
8.2	1			1				1		1		1	
8.3	2		2					2		2		2	
8.4.1	4			4				4		4			4
8.4.2	3			3				3		3			3
8.5	4		4					4		4		4	
Ques 8	16	2	6	8	0	0	0	16	0	16	2	7	7
9.1.1	3			3				3		3	3		
9.1.2	1	1						1		1	1		
9.2	2		2					2		2		2	
9.3	1				1			1		1	1		
9.4	1		1					1		1	1		
9.5	1			1				1		1			1
9.6.1	3			3				3		3		3	
9.6.2	5			5				5		5			5
9.6.3	2			2				2		2	2		
Ques 9	19	1	3	14	1	0	0	19	0	19	8	5	6
10.1	1		1						1	1			1
10.2	5		5						5	5			5
10.3.1	2	2							2	2	2		
10.3.2	3			3					3	3	3		
10.3.3	2				2				2	2		2	
Ques 10	13	2	6	3	2	0	0	0	13	13	5	2	6
SUMMARY													
QUES 1	20	6	4	8	2	10	2	6	2	20	10	6	4
QUES 2	14	2	3	2	7	14	0	0	0	14	5	2	7
QUES 3	16	2	8	6	0	16	0	0	0	16	3	10	3
QUES 4	11	2	6	3	0	11	0	0	0	11	2	9	0
QUES 5	14	2	5	7	0	14	0	0	0	14	2	5	7
QUES 6	13	2	7	4	0	0	13	0	0	13	4	7	2
QUES 7	14	2	3	6	3	0	0	14	0	14	2	9	3
QUES 8	16	2	6	8	0	0	0	16	0	16	2	7	7
QUES 9	19	1	3	14	1	0	0	19	0	19	8	5	6
QUES 10	13	2	6	3	2	0	0	0	13	13	5	2	6
Total mark	150	23	51	61	15	65	15	55	15	150	43	62	45
Norm mark	150	22,5	52,5	60	15	65	15	55	15	150	45	60	45
Total %	100	15	34	41	10	100	100	100	100	100	29	41	30
Norm %	100	15	35	40	10					0	30	40	30