education

Lefapha la Thuto la Bokone Bophirima
Noord-Wes Onderwys Departement
North West Education Department
NORTH WEST PROVINCE



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.

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QUESTION 1/VRAAG 1

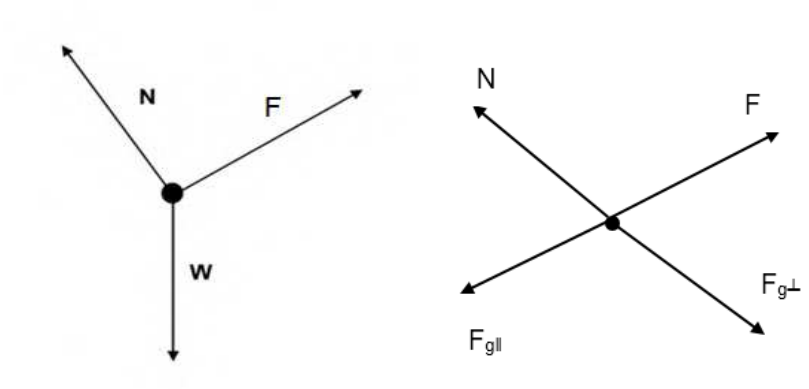
1.1	C	✓✓	(2)
1.2	D	✓✓	(2)
1.3	A	✓✓	(2)
1.4	D	✓✓	(2)
1.5	B	✓✓	(2)
1.6	C	✓✓	(2)
1.7	D	✓✓	(2)
1.8	A	✓✓	(2)
1.9	C	✓✓	(2)
1.10	B	✓✓	(2)

[20]

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QUESTION 2 /VRAAG 2

2.1



Accept the following symbols	
N ✓	F_N/Normal/Normal force *Normaal/Normaalkrag*
F ✓	F_A/Applied force force/ 5000 N F_A/*Toegepaste krag*/ 5000 N
w ✓OR $F_{g\parallel}$ and $F_{g\perp}$	F_g/mg/weight/ gravitational force F_g/mg/*gewig/ gravitasiekrag*

(3)

2.2 $F_{g\parallel} = w \sin\theta$ ✓
$5000 = w \sin 15^o$ ✓
$w = 19318,52$ N
$M_E = \frac{(19318,52)}{9,8} - 800$ ✓
$= 1171,28$ 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)

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2.4.2 $F_{g\parallel} = w \sin\theta$
$= (98)(\sin\theta)$
$F_{g\perp} = w \cos\theta$
$= (98)(\cos\theta)$
$7\ F_{g\parallel} = 4\ F_{g\perp}$ ✓
$7\ (98)(\sin\theta) = 4\ (98)(\cos\theta)$ ✓
$\tan\theta = 0,5714$
$\theta = 25,53^{o}$ ✓
Note: By using tanθ - 2/3 marks
Nota*: *Gebruik van tanθ - 2/3 punte
$\tan\theta = \frac{4}{7}$ ✓
$\theta = 25,53^{o}$ ✓ (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 $m \cdot s^{-2}$ ✓ downwards ✓/ *afwaarts* ✓ (2)

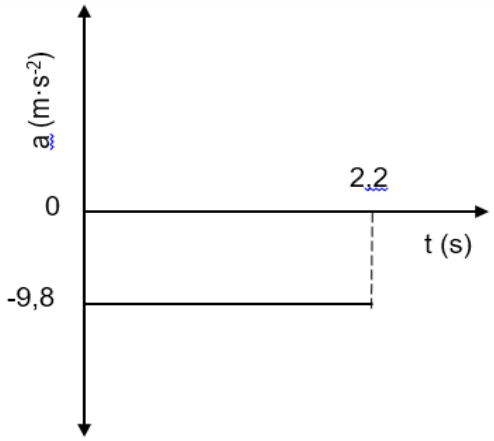
3.2.3 1,4 + 0,8 = 2,2 s ✓✓ (2)

3.3.1 $v_f = v_i + a\Delta t$ ✓
$0 = v_i + (-9,8)(1,4)$ ✓
$v_i = 13,72\ m \cdot s^{-1}$ ✓ (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
$\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓
$\Delta y = (13,72)(2,2) + \frac{1}{2}(-9,8)(2,2^2)$ ✓
$= 6,47\ m$ ✓ (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 is 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/*of* 0) (2)

4.2 $F_{net}\,\Delta t = \Delta P$ ✓
$(-1,2)(\Delta t) = (-0,24)$ ✓
$\Delta t = 0,2$ s ✓ (3)

4.3

OPTION 1	**OPTION 2**
$F_{net}\,\Delta t = \Delta P = m(v_f - v_i)$✓	$\Delta P = m(v_f - v_i)$✓
$(-1,2)\,(0,2) = 0,6\,(v_f - 0,5)$ ✓	$(-0,24) = 0,6\,(v_f - 0,5)$ ✓
$v_f = 0,1$ m·s^{-1} towards east ✓	$v_f = 0,1$ m·s^{-1} towards east ✓

(3)

4.4 $E_{kbefore} = E_{kafter}$ } any one / *enige een*✓
$E_k = ½\,mv^2$
$0,042 = ½\,(0,8)(v_f)^2$ ✓
$v_f = 0,32$ m·s^{-1}.✓ (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 ✓ $= \underline{(E_{Kf} – 0) + (0 – (75)(9,8)(25))}$ ✓
$E_{Kf} = 18375$ J ✓
(4)

5.3 **POSITIVE MARKING FROM QUESTION 5.2**
POSITIEWE NASIEN VANAF 5.2
$W_{nc} = \Delta E_K + \Delta E_p$
$W_{nc} = (E_{Kf} - E_{Ki}) + (E_{pf} – E_{pi})$
$= \underline{(0-18375)}$ ✓$+ \underline{(0 – (75)(9,8)(20)}$ ✓
$= (- 18375) + (-14700)$
$= - 33075$ J ✓
(3)

5.4 33075 J ✓ (1)

5.5 **POSITIVE MARKING FROM QUESTION 5.3**
POSITIEWE NASIEN VANAF 5.3
$W_{nc} = F\Delta x \cos\theta$ ✓
$- 33075$ ✓ $= F_T \times 20 \cos 180^\circ$ ✓
$F_T = 1653,75$ N ✓
(4)
[14]

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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	**OPTION 2**
$f_{(recorded)} = \frac{(4)}{(1 \times 10^{-4})}$ ✓	$f_{(recorded)} = \frac{(2)}{(5 \times 10^{-5})}$ ✓
= 40000 Hz	= 40000 Hz
= 40 kHz	= 40 kHz
40-38 = 2 kHz ✓	40-38 = 2 kHz ✓

(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 golffronte plaas ✓en meer golwe arriveer per sekonde ✓ (2)

6.4 **OPTION 1 / OPSIE 1**

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

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

$V_s = 71{,}43\ m \cdot s^{-1}$ ✓ (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. ✓

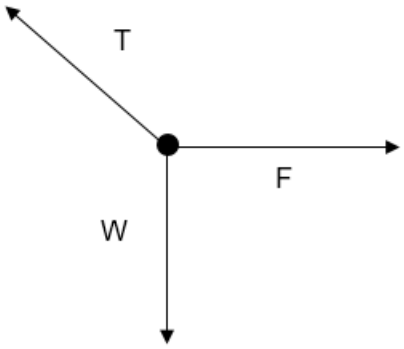
Die lig vanaf verafgeleë planete wat observeer word van die aarde het `n laer frekwensie en langer golflengte ✓, daarom vind `n verskuiwing na die rooi gedeelte van die speltrum plaas ✓ (2)

[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 elektrostatiese 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 / Elektrostatiese afstotingskrag
w ✓	F_g/mg/weight/$F_{earth\ on\ sphere}$/gravitational force F_g/mg/*gewig*/$F_{aarde\ op\ sfeer}$/*gravitasiekrag force*

(3)

7.3.1 Forces are in equilibrium / *Kragte is in ewewig*
w = mg
= (0,0009)(9,8) ✓
= 0,0088 N
$\tan 45^\circ = \frac{(F)}{(0,0088)}$ ✓

=0,008 N repulsion to the right. / *afstotend na regs*✓ (3)

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

$F = \frac{kQ_1Q_2}{r^2}$ ✓

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

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

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

Stanmorephysics.com

7.4.1 $F = \frac{kQ_1Q_2}{r^2}$

'F' at 'C' due to A

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

= 1,152 N to the right / *na regs*

'F' at 'C' due to B

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

= 2,7 N to the left / *na links*

Net electrostatic force at C =1,152 -2,7 = - 1,548 N· to the left ✓

Netto elektrostatiesekrag by C =1,152 -2,7 = - 1,548 N· na links ✓ (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 weestand in die battery as gevolg van die beweging van lading (2)

8.2 $V_2 = 2V_3$✓
OR
$V_3 = ½ V_2$ (1)

8.3 $V_1 = V_2 + V_3$
$21 = V_2 + ½ V_2$
$V_2 = 14$ V ✓
$V_3 = 7$ V ✓ (2)

8.4.1 $V_{lost} = 24-21$
$= 3$ V ✓
$V_{lost} = I_r$ ✓
$3 = 3r$ ✓
$r = 1\ \Omega$ ✓ (4)

8.4.2

OPTION 1	**OPTION 2**
$R = \frac{V}{I}$ ✓	$R = \frac{V}{I}$ ✓
$V_2 = 14$ V	$V_3 = 7$ V
$14 = 3R$ ✓	$7 = 3R_T$
$R = 4,67\ \Omega$ ✓	$7 = (3)\frac{(R)}{2}$ ✓
	$R = 4,67\ \Omega$ ✓

(3)

8.5 $P = VI$
$60 = 12 \times I$ ✓
$I = 5$ A
$Q = It$ ✓
$= 5x2x60$ ✓
$= 600$ 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 vloei 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 $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓

$V_{rms} = \frac{17}{\sqrt{2}}$ ✓

V_{rms} = 12,02 V ✓



$V_{wgk} = \frac{V_{max}}{\sqrt{2}}$

$V_{wgk} = \frac{17}{\sqrt{2}}$

V_{wgk} = 12,02 V

(3)

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9.6.2 **POSITIVE MARKING FROM QUESTION 9.2.1**

$P_{ave} = I_{rms} \times V_{rms}$ ✓
$15 = I_{rms} \times 12,02$ ✓
$I_{rms} = 1,25$ A

$$I_{rms} = \frac{I_{max}}{\sqrt{2}}$$ ✓

$$1,25 = \frac{I_{max}}{\sqrt{2}}$$ ✓

$I_{max} = 1,77$ A ✓

POSITIEWE NASIEN VANAF VRAAG 9.2.1

$P_{gem} = I_{wgk} \times V_{wgk}$ ✓
$15 = I_{wgk} \times 12,02$ ✓
$I_{wgk} = 1,25$ A

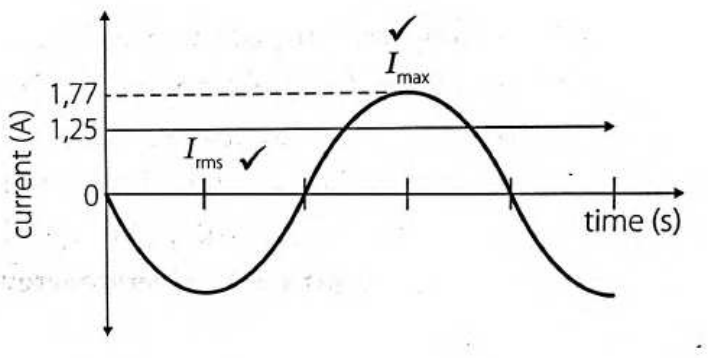
$$I_{rms} = \frac{I_{max}}{\sqrt{2}}$$ ✓

$$1,25 = \frac{I_{max}}{\sqrt{2}}$$ ✓

$I_{maks} = 1,77$ A ✓

(5)

9.6.3 **POSITIVE MARKING FROM QUESTION 9.2.2**
POSITIEWE NASIEN VANAF VRAAG 9.2.2



<u>Marking Criteria / Nasien kriteria</u>

- 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 $E = W_o + E_{k(max)}$ ┐ any one / enige een ✓
$E = hf_o + ½ mv^2$ ┘
$\underline{(6{,}63 \times 10^{-34})(5 \times 10^{15})}$ ✓= $\underline{(6{,}63 \times 10^{-34})(f_o)}$ ✓+ $\underline{(½ \times 9{,}1 \times 10^{-31})(5 \times 10^{5})^2}$✓
$f_0 = 4{,}8 \times 10^{15}$ Hz ✓ (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 $W_o = hf_o$ ✓
$\underline{9{,}44 \times 10^{-19} = (6{,}63 \times 10^{-34})(f_o)}$ ✓
$f_o = 1{,}42 \times 10^{15}$ Hz ✓ (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 unltraviolet lig (wat in die dag gekry word) is groter as die drumpelfrekwensie van selenium.✓ (2)
[13]

TOTAL/*TOTAAL*: 150

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SUBJECT: PHYSICAL SCIENCES PAPER 1										GRADE 12			
ANALYSIS GRID										SEPTEMBER 2022			
		Cognitive Levels				Topics					Difficulty Levels		
QUESTION	Mark	1	2	3	4	Mechanics ≈ 65Marks	Waves,Sound & Light ≈ 15 Marks	Electricity & Magnetism ≈ 55 Marks	Matter & Materials ≈ 15 Marks	TOTAL	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		
32.2.	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**

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