CAPE WINELANDS EDUCATION DISTRICT

CURRICULUM AND ASSESSMENT POLICY STATEMENT

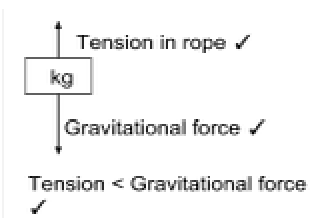
GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)

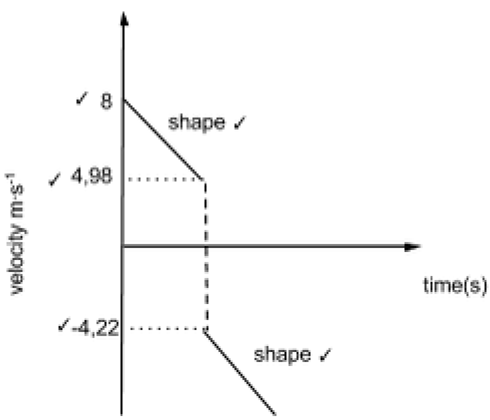
SEPTEMBER 2015 MEMORANDUM

MARKS 150

TIME 3 hours

QUESTION 1			
1.1	A✓✓		(2)
1.2	A✓✓		(2)
1.3	D ✓✓		(2)
1.4	A ✓✓		(2)
1.5	D ✓✓		(2)
1.6	C ✓✓		(2)
1.7	A ✓✓.		(2)
1.8	B ✓✓		(2)
1.9	B ✓✓		(2)
1.10	C ✓✓		(2)
			[20]
QUESTION 2			
2.1	When a resultant/net force acts on an object, the object will accelerate in the direction of the force ✓the acceleration is directly proportional to the force and inversely proportional to the mass of the object.✓		(2)
2.2			(3)
2.3	downward = positive (clockwise) $F_{tension} + F_{gravitation} = F_{resultant}$✓ $F_{tension} + (2)(9,8) = 2(3)$✓		(3)

	$F_{tension}$ = -13,6 N $F_{tension}$ = 13,6 N ✓ upward	
2.4	Right = positive (clockwise) $F_{rope} + F_{friction} = F_{resultant}$✓ 13,6 N + $F_{friction}$ =4(3)✓ $F_{friction}$ = -1,6 N Magnitude of friction force: 1,6 N ✓	(3)
2.5	The force that the rope exerts on the box✓ and the force that the box exerts on the rope.✓ OR the force that the Earth exerts on the box and the force that the box exerts on the Earth.	(2)
		[13]
QUESTION 3		
3.1	The product of the resultant/net force acting on an object and the time the resultant/net force acts on the object.✓✓	(2)
3.2	Right = positive $F\Delta t = m\Delta v = m(v_f - v_i)$✓ (or other correct form of the equation) F(0,1) = 0,4[1,49 - (-6)]✓ F = 29,96 N ✓	(3)
3.3	The total linear momentum of a closed system✓ remains constant (is conserved)✓	(2)
3.4	$m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v$✓(Right = positive) $50v_{1i}$ + (0,4)(-6) = 50,4(1,49)✓ $v_{1i} = 1,55\ m{\cdot}s^{-1}$✓	(3)
3.5	Total kinetic energy before collision: $\frac{1}{2}m_1v_{1i}^2 + \frac{1}{2}m_2v_{2i}^2$ $= (0,5)(50)(1,55)^2 + (0,5)(0,4)(-6)^2$✓ =67,26 J✓ Total kinetic energy after collision: $\frac{1}{2}(m_1 + m_2)v^2$ $= (0,5)(50,4)(1,49)^2$✓ = 55,95 J✓ $E_{k\ before} \neq E_{k\ after}$✓ *inelastic* collision.	(5)
		[15]

QUESTION 4		
4.1	$v_f^2 = v_i^2 + 2\,g\Delta y$✓ (Upwards = positive) $v_f^2 = (8)^2 + 2(-9{,}8)(2)$✓ v_f = 4,98 m·s^{-1}✓	(3)
4.2	Time it took to reach the ceiling: $v_f = v_i + gt$✓ 4,98 = 8 + (-9,8)t✓ t = 0,31 s. Therefore: time it took for ball to bounce back: 0,65 - 0,31 = 0,34 s✓ initial velocity of the ball when it bounce back: $\Delta y = v_i t + ½ gt^2$✓ $2 = v_i(0{,}34) + (0{,}5)(9{,}8)(0{,}34)^2$✓ v = 4,22 m·s^{-1}✓.	(6)
4.3		(5)
		[14]
QUESTION 5		
5.1	A force for which the work done in moving an object between two points depends on the path taken/is not independent of the path taken✓✓	(2)
5.2	0 J ✓	(1)
5.3	$Fg_{//}$ - (f + F) = 0✓ (Accept other correct symbols) OR/*OF* F = mg sinθ – f_k **OR/*OF*** F = mgsinθ – 266 F = [100(9,8) sin 25 ^{o}]✓ – 266✓	

	414,167- 266 F = 148,17 N✓ **NOTE/*LET WEL*** No mark for diagram 1 mark for use of any of the three formulae		(4)
5.4	**OPTION 1/*OPSIE 1*** 1 mark for any of the three/ *1 punt vir enige van die drie* $W = F\Delta x \cos\theta$ $W_{net} = W_f + W_g + W_N$ $W_{net} = f_k \Delta x \cos 180°$✓ + $mg\sin\theta \Delta x \cos 0° + 0$ = (266)(3)(-1) ✓+ [100(9,8) sin 25° (3)(1)]✓ + 0 = 444,5 J $W_{net} = \Delta E_K / \Delta K = ½ m(v_f^2 - v_i^2)$ ✓ 444,5 = ½ (100) (v_f^2 – 0) ✓ v_f = 2,98 m·s^{-1}✓ **OPTION 2/*OPSIE 2*** $W_{nc} = \Delta E_p + \Delta E_k$ ✓ $f\Delta x\cos\theta$ ✓= ($mgh_f - mgh_i$) + (½ mv_f^2 – ½ mv_i^2) 266Δx cos180° ✓ = (0 - mgsin25° Δx cos0°) + (½ mv_f^2 – 0) 266(3)(-1) = [-100(9,8) sin 25° (3)(1)] ✓ -½ (100) (v_f^2 – 0)✓ v_f = 2,98 m·s^{-1}✓ **OPTION 3/*OPSIE 3*** **POSITIVE MARKING FROM QUESTION 5.3** ***POSITIEWE NASIEN VANAF VRAAG 5.3*** $W_{net} = \Delta E_k$ ✓ $F_{net}\Delta x\cos\theta$ ✓= ½ $m(v_f^2 - v_i^2)$ (148,17)✓(3)cos0°✓ = ½ (100)(v_f^2 - 0^2) 444,51 = 50v_f^2 ✓ v_f = 2,98 m·s^{-1} ✓ **OPTION 4/*OPSIE 4*** **POSITIVE MARKING FROM QUESTION 5.3** ***POSITIEWE NASIEN VANAF VRAAG 5.3*** F_{net} = ma ✓ 148,17✓ =100a ✓ a = 1,48 m·s^{-2} $v_f^2 = v_i^2 + 2a\Delta x$ ✓ = 2(1,48)(3) ✓ v_f = 2,98 m·s^{-1} ✓		(6)

OPTION 5/*OPSIE 5*
POSITIVE MARKING FROM QUESTION 5.3
POSITIEWE NASIEN VANAF VRAAG 5.3

$F_{net} = ma$ ✓
$148,17$ ✓ $= 100a$ ✓
$a = 1,48\ m\cdot s^{-2}$

$\Delta x = v_i\Delta t + ½a\Delta t^2$
$3 = 0 + ½(1,48)\Delta t^2$
$\Delta t = 2,01\ s$

$v_f = v_i + a\Delta t$ ✓
$= 0 + (1,48)(2,01)$ ✓
$v_f = 2,97\ m\cdot s^{-1}$ ✓

OPTION 6/*OPSIE 6*
POSITIVE MARKING FROM QUESTION 5.3
POSITIEWE NASIEN VANAF VRAAG 5.3

$F_{net} = ma$ ✓
$148,17$ ✓ $= 100a$ ✓
$a = 1,48\ m\cdot s^{-2}$

$\Delta x = v_i\Delta t + ½a\Delta t^2$
$3 = 0 + ½(1,48)\Delta t^2$
$\Delta t = 2,01\ s$ ✓

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓
$3 = \left(\frac{0 + v_f}{2}\right)(2,01)$
$v_f = 2,99\ m\cdot s^{-1}$ ✓

[13]

QUESTION 6

6.1.1	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 ✓ ✓	(2)
6.1.2	increase ✓	(1)
6.1.3	As the police officer move closer to the alarm, he would observe a sound with a shorter wavelength ✓ than was originally omitted. Since the wavelength is inversely proportional to the frequency of the wave, the frequency will increase (become more / higher). ✓	(2)
6.1.4	$f_L = \frac{v + v_L}{v} f_s$ ✓ (OR Formula as on data sheet) $= \frac{340 + 40}{340}$ ✓ (1200) ✓ $= 1\ 341,\ 18\ Hz$ ✓	(4)

6.2.1	An atomic absorption spectrum is formed when certain frequencies of electromagnetic radiation that passes through a medium✓, e.g. a cold gas, is absorbed.✓ An atomic emission spectrum is formed when certain frequencies of electromagnetic radiation are emitted✓ due to an atom's electrons making a transition from a high-energy state to a lower energy state.✓	(4)
6.2.2	The absorbed electromagnetic radiation for the light from Andromeda appear at higher frequencies than the absorbed electromagnetic radiation for light from the Sun.✓	(1)
6.2.3	Blue shift ✓	(1)
		[15]
QUESTION 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 the charges and inversely proportional to the square of the distance (r) between them:✓✓	(2)
7.2	$F = \frac{kQ_1Q_2}{r^2}$✓ $7{,}2 \times 10^{-6} = \frac{9\times10^9 \times Q \times 16 \times 10^{-9}}{(0{,}4)^2}$✓ $Q_A = -8$ nC.✓	(3)
7.3	Electric field at P due to A $E = \frac{kQ}{r^2}$✓ $= \frac{9\times10^9 \times 8 \times 10^{-9}}{(0{,}3)^2}$✓ = 800 $N{\cdot}C^{-1}$✓ Electric field at P due to B $E = \frac{9\times10^9 \times 16 \times 10^{-9}}{(0{,}7)^2}$✓ = 293,88 $N{\cdot}C^{-1}$✓ 800 + 293,88 = 1 093,88 $N{\cdot}C^{-1}$✓	(6)
7.4	**B TO A**✓	(1)
7.5	$\frac{8nC + 16nC}{2}$ = 12 nC✓ 4 nC electrons were transferred from B to A✓ $\frac{4\times10^{-9}}{1{,}6\times10^{-19}}$ ✓= 2,5 x 10^{10} ✓electrons	(4)
		[16]

QUESTION 8			
8.1	The potential difference across a conductor is directly proportional to the current in the conductor✓ at constant temperature.✓		(2)
8.2	Negative✓		(1)
8.3	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$✓ $\frac{1}{R} = \frac{1}{4} + \frac{1}{2}$✓ R = 1,33$\Omega$✓		(3)
8.4	V = IR✓ 3,9 = I x 1,33✓ I = 2,925 A✓ $\varepsilon = IR + Ir$✓ 6 = 3,9 + 2,925 r✓ r = 0,72Ω✓		(6)
8.5	$\frac{2{,}925}{3}$ ✓= 0,975 A.✓ or V = IR 3,9 = I (4)✓ I = 0,975 A✓		(2)
8.6.1	Increase✓		
8.6.2	Stays the same ✓		(1)
8.7	$\varepsilon = I(R + r)$✓ 6 = I (4 + 0,72)✓ I = 1,27 A✓		(3)
			[19]
QUESTION 9			
9.1.1	Generator ✓		(1)
9.1.2	Kinetic/mechanical energy✓ → electrical energy ✓		(2)
9.1.3	B to A ✓		(1)
9.1.4	DC ✓		(1)

9.1.5	The split ring commutator ensures✓ that the current that passes through to the external circuit is always in the same direction.✓		(2)
9.1.6	Use a coil that consist of more windings ✓ Increase the strengths of the magnets.✓		(2)
9.2.1	The rms value of AC is the DC potential difference which dissipates the same amount of energy as AC✓✓		(2)
9.2.2	$V_{rms} = \frac{V_{max}}{\sqrt{2}}$✓ $= \frac{39,45}{\sqrt{2}}$✓ = 27,9 V ✓		(3)
9.3	It can be stepped up or stepped down / is easier to transmit ✓		(1)
			[15]
QUESTION 10			
10.1.1	Photoelectric effect ✓.		(1)
10.1.2	$W_o = hf_o$✓ $= 6,63 \times 10^{-34} \times 4,389 \times 10^{14}$ ✓ $= 2,91 \times 10^{-19}$ J✓		(3)
10.1.3	E = hf $= 6,63 \times 10^{-34} \times 4,83 \times 10^{14}$ $= 3,2 \times 10^{-19}$J $E = hf_o + ½ mv^2$ ✓ $3,2 \times 10^{-19}$✓ $= 6,63 \times 10^{-34} \times 4,39 \times 10^{14} + (0,5)(9,11 \times 10^{-31}) v^2$✓ $v = 2,5 \times 10^5$ m·s^{-1}✓		(4)
10.2.1	Increase ✓		(1)
10.2.2	increase✓		(1)
			[10]
	TOTAL		**[150]**