First Semester

Physics

كلية الحرس التقنية

(Answers)

GENERAL EDUCATION DIPLOMA EXAMINATION

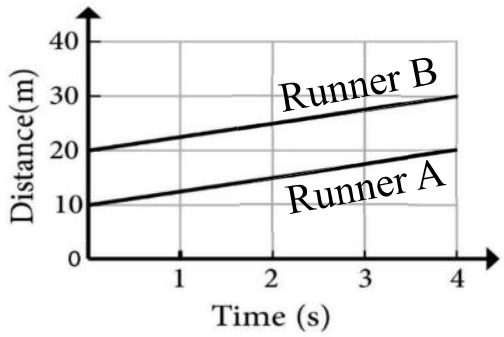
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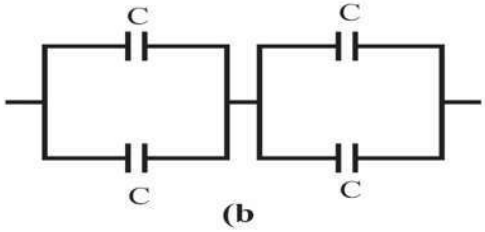
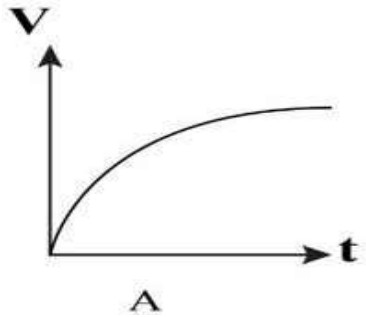
Physics 1st Semester, 1st Session 2023-2024

Marking Guide

Note: the marking guide in (9) pages — Full marks: (70)

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Answer	Mark	C.L	Ob	page
1	d	Ohm	1	k	1.3a	5
2	c	10A	1	A	1.3d	8
3	b	1.7A	1	A	1.6d	15
4	a	3 | 12	1	R	1.3c	5-6
5	d	D	1	K	1.3c	6
6	a	8	1	A	1.3c	6+10
٧	d		1	A	2.3b	٣٩
٨	c	Y	1	K	2.2f	٤٥

Item	Answer	Answer	Mark	C.L	Ob	page
٩	a	PQ	1	A	2.3b	٤١_٤٥
١٠	b	Inertia	1	K	2.2a	٣٣
١١	a	8N	1	A	2.2f	٤٥_٤٦
١٢	b	240	1	R	2.2d	٣٧
١٣	b	 (b	1	R	3.1c	٥٦_٥٧
١٤	a	 A	1	A	3.1e	٥٥

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

<table>
<tr><th>Item</th><th>Part</th><th>Answer</th><th>Mark</th><th>C.L</th><th>O.B</th><th>Page</th></tr>
<tr><td rowspan="4">15</td><td>a</td><td><table><tr><th>Circuits Type</th><th>Voltage</th><th>Current</th></tr><tr><td>Parallel</td><td>Common</td><td>Divides</td></tr><tr><td>Series</td><td>Divides</td><td>Common</td></tr></table><u>(one mark for each correct completion)</u></td><td>4</td><td>K</td><td>1.5a</td><td>10-13</td></tr>
<tr><td>b</td><td>The algebraic sum of the currents entering and leaving a junction is equal to zero.</td><td>1</td><td>K</td><td>1.6a</td><td>12</td></tr>
<tr><td>c(i)</td><td>$I_1 = I_2 + I_3$
$I_2 = 3 - 1 = 2A$
The (abcfa) loop.
$V - (3 \times 2) - (2 \times 2) = 0$
$V - 6 - 4 = 0$
$V = 10V$</td><td>1
1

1

1</td><td>A</td><td rowspan="2">1.6d</td><td rowspan="2">10-29</td></tr>
<tr><td>c(ii)</td><td>$10 - 6 - R_3 = 0$
$R_3 = 10 - 6$
$R_3 = 4\Omega$
<u>(Another solution) :</u>
$I_2R_2 = I_3R_3$
$2 \times 2 = 1 \times R_3$ ⟶ (١)
$R_3 = 4\Omega$ ⟶ (1)</td><td>1

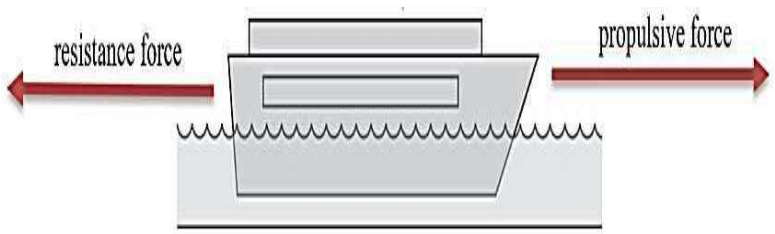
1</td><td>A</td></tr>
</table>

Item	Part	Answer	Mark	C.L	O.B	Page
16	a	When a conductor is at a constant temperature the current in the conductor is proportional to the potential difference across it.	1	K	1.3a	6
	b	When opened (S): $I = \frac{\varepsilon}{R_1+6}$ $1.2 = \frac{12}{R_1+6}$ $R_1 + 6 = 10$ $R_1 = 10 - 6 = 4\ \Omega$ $R_1 = 4\ \Omega$ When closed (S) : $\frac{1}{R_T} = \frac{1}{R_2} + \frac{1}{6}$ $I = \frac{\varepsilon}{R_T+4}$ $2 = \frac{12}{R_T+4}$ $R_T = 6 - 4$ $R_T = 2\Omega$ $\frac{1}{R_T} = \frac{1}{R_2} + \frac{1}{6}$ $\frac{1}{2} = \frac{1}{R_2} + \frac{1}{6}$ $R_2 = 3\Omega$ **(Another solution):** When opened (S) $I = \frac{\varepsilon}{R_1+6}$ $1.2 = \frac{12}{R_1+6}$ ⟶ (١) $R_1 + 6 = 10$ $R_1 = 10 - 6 = 4\Omega$ ⟶ (١) When closed(S) $R_T = \frac{V_T}{I_T} = \frac{12}{2}$ ⟶ (١) $R_T = 6\Omega$ Parallel $R_{2,6} = \frac{6R_2}{6+R_2}$ $R_T = \left(\frac{6R_2}{6+R_2}\right) + R_1$ ⟶ (١) $6 = \frac{6R_2}{6+R_2} + 4$ $R_2 = 3\Omega$ ⟶ (١)	1 1 1 1 1 1	R	1.3c	6-7

Item	Part	Answer	Mark	C.L	B.O	Page
17	a	"The sum of voltages around a loop (or mesh) must equal 0V"	1	K	1.6b	18
	b	Slope = R= $\frac{10-4}{2.5-1} = \frac{6}{1.5}$ $R = 4\Omega$ (Any two points give the same result)	1 1	A	1.3c	6-7

18	a	Total resistance of the circuit $R = \frac{10 \times 15}{10 + 15}$ $R = 6\,\Omega$ $R_T = 6 + 10 = 16\,\Omega$	1 1	A	1.5a	10
	b	$I = \frac{V}{R_T}$ $I = \frac{20}{16} = 1.25A$ $V_3 = I \times R_3$ $V_3 = 1.25 \times 10$ $V_3 = 12.5\,V$	1 1	A	1.5b	٨

Item	Part	Answer	Mark	C.L	B.O	Page
19	a	Distance = area under the graph t = 0s to 3s $d_1 = 0.5 \times 3 \times (10 - 4)$ $d_1 = 9\ m$ $d_2 = 4 \times 3$ $d_2 = 12$ Total distance= 12+9=21 m (If the student writes the solution in one step give a full mark)	1 1 1	A	2.3b	٤١-٤٢
	b	$a = \frac{\Delta v}{\Delta t}$ $a = \frac{0 - 10}{5 - 0} = \frac{-10}{5}$ $a = -2\ m/s^2$ (accept the answer without minus)	1 1	A	2.3c	40-41
	c	For cart 1: $S_1 = ut + \frac{1}{2}at^2$ $S_1 = 10t - 0.5 \times 2 \times t^2$ For cart 2: $S_2 = ut + \frac{1}{2}at^2$ $S_2 = 4t - 0.5 \times (0) \times t^2$ $S_2 = 4t$ So, $S_1 = S_2$ $10t - 0.5 \times 2 \times t^2 = 4t$ $t^2 = 6t$ $t = 6\ s$ (Do not accept without steps)	1 1 1	R	2.1c	42

Item	Part	Answer	Mark	C.L	B.O	Page
20	a	One mark for each force  	2	K	2.2e	46
	b	$v = u + at$ $10 = 0 + a(600)$ $a = \frac{1}{60} = 0.0166\ m/s^2$ $F_{\text{propulsive force}} - F_{\text{resistance force}} = ma$ $F_{\text{propulsive force}} - 2780000 = 5 \times 10^{8} \times \frac{1}{60}$ $F_{\text{propulsive force}} = 11.1 \times 10^{6}\ \text{N}$	1 1 1	A	2.2f	42-46

Item	Part	Answer	Mark	C.L	B.O	Page
21	a(i)	a body remains in a state of rest or of uniform motion in a straight line, unless it is acted upon by some external resultant force.	1	K	2.2d	34
	a(ii)	For every action there is an equal and opposite reaction	1	K	2.2d	35
	b	Possible If the speed of the car (M) increases twice to get the same momentum **(Anothor soultion):** Possible ⟶ (1) $P_1 = m_1 v_1$,$(m_1 = \mathrm{M}, v_1 = 2v)$ $P_1 = 2Mv$ $P_2 = m_2 v_2$, $(m_2 = 2\mathrm{M}, v_2 = v)$ $P_2 = 2Mv$ $P_1 = P_2$ ⟶ (1)	1 1	R	2.2d	34
	c	$F = \frac{m(v-u)}{\Delta t}$ $F = \frac{2(0-6)}{2}$ $F = -6\ N$ (accept the answer without minus)	1 1	A	D2.2	37

Item	Part	Answer	Mark	C.L	B.O	Page
22	a	Inelastic collisions. Because, the objects stick together. (Accept similar meaning)	1 1	K	2.6.c	48-49
	b	$m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$ $2.5 \times 0.9 + (1.8 \times -1.4) = (0.9 + 1.8)v$ $-0.27 = 2.7v$ $v = -0.1\ m/s$	1 1	A	2.6.d	48-49
	c	To the left	1	K	2.6.d	٤٩-٤٨

Item	Part	Answer	Mark	C.L	B.O	Page
23	a	A , B, C (one mark for each)	3	K	3.1.e	55
	b	Increase	1	R	3.1.g	56-57
24		$C_{t1}=\frac{1}{\frac{1}{10}+\frac{1}{10}}=5\mu F$ C_{t1},5 μF in parallel: $C_{t2}=5\mu+5\mu=10\ \mu F$ C_{t2},15μ in series: $C_{total}=\frac{1}{\frac{1}{10}+\frac{1}{15}}$ $C_{total}=6\ \mu F$	1 1 1 1	A	3.1.d	56-57

End of Marking Guide

GENERAL EDUCATION DIPLOMA EXAMINATION

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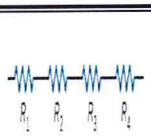
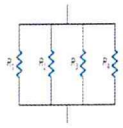
Physics 1st Semester, 1st Session 2022-2023

Marking Guide

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Answer	Mark	C.L	page
1	b	Coulomb	1	K	5
2	c	Voltage	1	K	5
3	c	8 | To the left	1	A	14
4	c	3.6 Ω	1	A	8
5	a	1 | Counter Clockwise	1	R	10
6	d	4 Ω	1	A	6
7	a	10 | To the left	1	A	32
8	a	Newton's first law	1	R	33
9	c	Distance	1	K	42
10	b	8 minutes	1	A	39
11	d	Speed	1	K	39
12	b	5 m/s^2	1	A	43
13	b	10 μF	1	A	57
14	d	d	1	R	53

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	Page
15		 	6	K	10-13

Connection type	**Series**	**Parallel**
Current	**Equal OR Same**	**Different values**
Total resistance	**Increased**	**Decreased**

(one mark for each correct completion)

16	a	For the parallel (40 Ω), (20 Ω) and (40 Ω) resistors Rp: $\frac{1}{R_p} = \frac{1}{40} + \frac{1}{20} + \frac{1}{40} = \frac{1}{10}$ Rp= 10 Ω Therefore, for the whole network: $R_T = Rp + 50$ $R_T = 10 + 50$ $R_T = 60\ \Omega$	1 1 1 1	A	10
	b	$V = IR$ $12 = I \times 60$ I= 0.2 A	1 1	A	8

Item	Part	Answer	Mark	C.L	Page
17	a	$I_3 = I_1 + I_2$ $I_1 = I_3 - 0.6$ Eq1 The abcfa loop: $12 - 3I_3 - 5I_1 - I_1 = 0$ $12 - 3I_3 - 6I_1 = 0$ $12 - 3I_3 - 6(I_3 - 0.6) = 0$ $I_3 = 1.73A$ $I_1 = I_3 - 0.6$ $= 1.73 - 0.6 = 1.13A$ Or The afcba loop: $5I_1 + 3I_3 - 12 + I_1 = 0$ *(one mark)* $6I_1 + 3I_3 - 12 = 0$ $I_3 = I_1 + I_2$ $6I_1 + 3(I_1 + I_2) - 12 = 0$ $6I_1 + 3I_1 + 3I_2 - 12 = 0$ $6I_1 + 3I_1 + 3(0.6) - 12 = 0$ (one mark) $6I_1 + 3I_1 + 1.8 - 12 = 0$ $I_1 = \frac{12-1.8}{9} = 1.13\ A$ (one mark) $I_3 = I_1 + I_2 = 1.13 + 0.6$ $I_3 = 1.73A$ (one mark)	1 1 1 1	A	14-29

17	b	The <u>cdefc</u> loop $5I_2 - \varepsilon + I_2 + 3I_3 = 0$ $6I_2 - \varepsilon + 3I_3 = 0$ $\varepsilon = 6(0.6) + 3(1.73)$ $\varepsilon = 8.79$ V Or The <u>cfedc</u> loop $-3I_3 - I_2 + \varepsilon - 5I_2 - = 0$ (one mark) $\varepsilon = 6I_2 + 3I_3$ $\varepsilon = 6(0.6) + 3(1.73)$ $\varepsilon = 8.79$ V (one mark)	1 1	A	14-29

Item	Part	Answer	Mark	C.L	Page
18	a	The sum of the voltage around a loop (or mesh) must equal 0V.	1	K	18
	b	When the four resistors are connected in series the equivalent resistance is given by $R_{eq} = 4R$ The power dissipated $P_1 = \frac{V^2}{R_{eq}} = \frac{V^2}{4R} = 25$ $\frac{V^2}{R} = 100$ Then, when the four resistors are connected in parallel the equivalent resistance is given by $R_{eq} = R/4$ The power dissipated in this case is $P_2 = \frac{V^2}{R_{eq}} = \frac{V^2}{R/4} = 4\frac{V^2}{R} = 400W$	1 1 1 1 1	R	8-9

Item	Part	Answer	Mark	C.L	Page
19	a	<table><tr><td></td><td></td></tr><tr><td></td><td>Second, Or 2, Or two</td></tr><tr><td></td><td>Third, Or 3, Or three</td></tr><tr><td></td><td>First, Or 1, Or one</td></tr></table> (one mark for each correct completion)	3	k	32-38
	b-i	(t =0.6s to 1.6s) Or, any time interval between B and C	1	R	45
	b-ii	$a = \frac{v-u}{t}$ $a = \frac{1.2-0}{0.6-0}$ $a = 2\ m/s^2$ $F = ma$ $F = 0.2 \times 2$ $F = 0.4\ N$	1 1 1 1	A	46
	b-iii	$v^2 = u^2 + 2as$ $s = \frac{v^2}{2a}$ $s = \frac{(1.2)^2}{2 \times 2}$ $s = 0.36\ m$ Or, area under the line $= \frac{1}{2} \times 0.6 \times 1.2 = 0.36m$	1 1	A	40

Item	Part	Answer	Mark	C.L	Page
20	a	After 100s	1	A	39-46
	b	$slope\ of\ b \rightarrow v_b = \frac{\Delta s}{\Delta t}$ $v_b = \frac{250-0}{225-100} = \frac{250}{125}$ $v_b = 2\,m/s$	1 1 1		
	c	student (b) because the slope of student (b) bigger than the slope of student (a) which is (0.67 m/s)	1 1	R	

Item	Part	Answer			Mark	C.L	Page
21			Elastic collision	Inelastic collision	4	K	48 -49
		Momentum	Conserved	Conserved			
		Kinetic energy	Conserved	Not conserved			
		(one mark for each correct completion)					

22	i	$m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$ $0.4 \times 6 + 0 = (0.4 + 0.4)v$ $2.4 = 0.8v$ $v = 3\ m/s$	1 1 1	A	47-50
	ii	Increase Because there is a direct relationship between momentum and the mass of the body. Or **P α m**	1 1	R	47-50

Item	Part	Answer	Mark	C.L	Page
23	a	$C' = 60\ \mu F + 20\ \mu F = 80\ \mu F$ $\frac{1}{C_T} = \frac{1}{80} + \frac{1}{40} = \frac{3}{80}$ $C_T = 26.7\ \mu F$ **or**, $C_T = 2.67 \times 10^{-5}\ F$	1 1	A	56-60
	b	$Q = C_T V$ $Q = (2.67 \times 10^{-5})(10)$ $Q = 267 \mu C$ **or**, $Q = 2.67 \times 10^{-4} C$	1 1	A	56-60
	c	i.The more charge can be stored ,or increase ii.The more charge can be stored, or increase	1 1	k	52

Item	Part	Answer	Mark	C.L	Page
24	a	Capacitance is the ability of a component or circuit to collect and store energy in the form of an electrical charge. **Or,** It is the amount of electric charge stored on a conductor for a stated difference in electric potential.	1	K	52
	b	Halve. Because the capacitance is inverse proportional to the voltage applied across the capacitor.	1	R	55

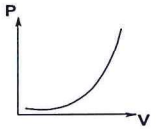
End Of Marking Guide

GENERAL EDUCATION DIPLOMA EXAMINATION

Royal Guard of Oman Technical College,

Physics 1st Semester, 1st Session 2021-2022

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

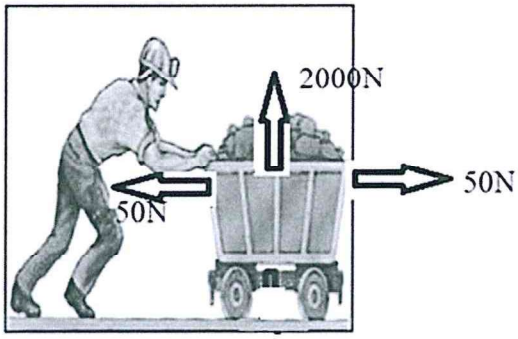
Item	Answer	Answer	Mark	C.L	page
1	b	Watt	1	K	8
2	b	Charge | Energy	1	K	14-18
3	a	30 Ω	1	A	10
4	c	1.2 Ω	1	A	8
5	b	0.5 | Counter Clockwise	1	A	14-18
6	d		1	R	8
7	a	The net force acting on it is equal to zero.	1	K	34
8	a	Newton's first law	1	K	34
9	a	F_E | Towards the moon	1	A	35
10	b	8000 N.s	1	A	48
11	c	120 m	1	A	41
12	b	2.78 | 0.56	1	R	39
13	a	C/V	1	A	53
14	c	C	1	R	52

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	Page
15	a	i. Kirchhoff's voltage law: *The sum of the voltage around a loop (or mesh) must equal 0V.* **Or** *The sum of electromotive forces in a closed circuit is equal to the sum of the potential differences.*	1	K	14-18
		ii. Kirchhoff's current law: *At any node (junction) in an electrical circuit, the sum of the currents flowing into that node is equal to the sum of the currents flowing out of that node.*	1		
	b	- from loop (abcda): $-100xI_1 + 1.5 = 0$ $\Leftrightarrow I_1 = 0.015A$	1 1	A	14-18
		- from loop (bcefb): $-9 + 200xI_2 + 100xI_1 = 0$ substituting the value I_1 into equation (3) $-9 - 200xI_2 + 100x0.015 = 0$ $200xI_2 = 7.5 \Leftrightarrow$ $I_2 = 0.0375A$ And then $I_3 = I_2 - I_1 = 0.0225A$	1 1		
		OR - from loop (adefa): $9 + 200xI_2 - 1.5 = 0$ $I_2 = 0.0375A$			

Item	Part	Answer	Mark	C.L	Page
16		<table><tr><th></th><th>Definition</th><th>SI unit</th></tr><tr><td>Currrent (I)</td><td>Charge passing a point in circuit in one second</td><td>Ampere OR (A)</td></tr><tr><td>Voltage (V)</td><td>The amount of work required to move a certain amount of charge from one place to another</td><td>Volt OR (V)</td></tr></table>	4	K	5
17	a	Ohm's law: *The voltage across a circuit element is proportional to the current flowing through that element.*	1	K	6
	b	$R = \frac{V}{I}$ $R = \frac{8}{4}$ $R = 2\Omega$ *OR* Slope = 1/R $slop = \frac{\Delta I}{\Delta V} = \frac{4-2}{8-4} = \frac{2}{4} = 0.5$ $R = \frac{1}{0.5} = 2\Omega$	1 1	A	6
	c	i. Doubled ii. Constant	1 1	R	6
18	a	The total resistance for the parallel combination is $\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R}$ $R_p = \frac{R}{3}$ The total resistance for the series combination is $R_s = R + R + R = 3R$ $\frac{R_p}{R_s} = \frac{\frac{R}{3}}{3R} = \frac{1}{9}$	1 1 1	R	10
	b-i	$E = R_T I \Leftrightarrow \frac{E}{I} = R_T,\ R_T = \frac{10}{2}$ $R_T = 5\Omega$	1 1	A	10-13
	b-ii	$R_{T(ab)} = R_T - 3$ $R_{T(ab)} = 5 - 3 = 2\Omega$	1 1	A	

	b-iii	$10-(3x2)-V_{ab}=0 \Leftrightarrow$ $V_{ab}=4V$ OR $V_{ab}=IR_{ab}$ Vab=2x2=4V	1 1	A	

Item	Part	Answer	Mark	C.L	Page
19	a		1 1 1	A	33
	b	Friction force	1	K	45
	c-i	$a=\frac{\Delta v}{\Delta t},\ a=\frac{0-2}{4}$ $a=-0.5m/s^2$ OR V=u+at, 0=2+a4 , $a=-0.5m/s^2$	1 1	A	40
	c-ii	$S=ut+\frac{1}{2}at^2$ $S=2x4-\frac{1}{2}(0.5)(4)^2$ $S=4m$ *OR* $S=\frac{1}{2}(u+v)t,\ S=\frac{1}{2}(0+2)4$ $S=4\ m$	1 1	A	40

20	a-i	The product of the mass of a body and its velocity	1	K	34
	a-ii	The change in velocity per unit time OR the rate of change of velocity	1	K	40
	b	Quantity: **speed** — Type of quantity: **scalar** — Definition: Distance per unit time Quantity: velocity — Type of quantity: **vector** — Definition: **displacement** per unit time	1 1 1 1	K	39
21	a	$p = mv$ $p = (2000)(25)$ $p = 50000N$	1 1	A	34
	b	$a = \frac{\Delta v}{\Delta t}, \quad a = \frac{0-25}{10}$ $a = -2.5m/s$ $F = ma$ $F = (2000)(-2.5)$ $F = -5000N$ OR V=u+at, 0=25+a10 $a = -2.5m/s^2$ $F = ma$ $F = (2000)(-2.5)$ $F = -5000N$	1 1 1	A	34-35
22	a	When the balloon is descending $Mg - T = Ma$ $T = M(g - a)$ $T = (8.5)(500)$ $T = 4250\ N$ After mass (m) is removed	1 1	R	37-38

		$(M-m)g = T$ $(500-m)(10) = 4250$ $m = 500 - \left(\frac{4250}{10}\right)$ $m = 75\ kg$	1 1 1		
23	a	- Area of each plate - Distance between the two plates - Material between the two plates	1 1 1	K	52
	b	$C_{1-2} = (6x3)/(6+3) = 2\ \mu F$ $C_{5-4} = (6x4)/(6+4) = 2.4\ \mu F$ $C_T = 2+2+2.4$ $C_T = 6.4\ \mu F$	1 1 1 1	A	56-60
	c	Decreases Because C_3 is connected in parallel.	1	R	56

End Of Marking Guide