SECTION A

<table>
<tr><th>Question 1</th><th>Marks</th><th>Answer</th></tr>
<tr><td>(a)(i)</td><td>1</td><td>State the correct manipulated variable
distance between double slit and screen, D</td></tr>
<tr><td>(ii)</td><td>1</td><td>State the correct responding variable
Distance between two consecutive blue fringes, x</td></tr>
<tr><td>(iii)</td><td>1</td><td>State the correct constant variable
Wavelength, λ // Distance of double slit, a</td></tr>
<tr><td>(b) (i)</td><td>2</td><td>Record 5 values of y correctly
<table><tr><th>Diagram</th><th>y / cm</th></tr><tr><td>1.2</td><td>2.1</td></tr><tr><td>1.3</td><td>4.2</td></tr><tr><td>1.4</td><td>6.3</td></tr><tr><td>1.5</td><td>8.4</td></tr><tr><td>1.6</td><td>10.6</td></tr></table>Note:
• All reading correct : 2 M
• 3-4 reading correct : 1 M
• 0-2 reading correct : 0 M
• No penalty for inconsistent decimal places</td></tr>
<tr><td>(ii)</td><td>2</td><td>Record 5 values of distance between two consecutive blue fringes, x correctly
<table><tr><th>Diagram</th><th>x / cm</th></tr><tr><td>1.2</td><td>0.70</td></tr><tr><td>1.3</td><td>1.40</td></tr><tr><td>1.4</td><td>2.10</td></tr><tr><td>1.5</td><td>2.80</td></tr><tr><td>1.6</td><td>3.53</td></tr></table>Note:
• All reading correct : 2 M
• 3-4 reading correct : 1 M
• 0-2 reading correct : 0 M
• No penalty for inconsistent decimal places</td></tr>
</table>

<table>
<tr>
<td>(c)</td>
<td>

1
1
1</td>
<td>Tabulate results for D, y and x in the space provide

<table>
<tr><th>D/m</th><th>y/cm</th><th>x / cm</th></tr>
<tr><td>0.5</td><td>2.1</td><td>0.70</td></tr>
<tr><td>1.0</td><td>4.2</td><td>1.40</td></tr>
<tr><td>1.5</td><td>6.3</td><td>2.10</td></tr>
<tr><td>2.0</td><td>8.4</td><td>2.80</td></tr>
<tr><td>2.5</td><td>10.6</td><td>3.53</td></tr>
</table>

All symbols of D, y and m are correct : 1M
All units are correct : 1M
All decimals places are consistent : 1M

Note:
• Deduct 1 mark if no table</td>
</tr>
<tr>
<td>(d)</td>
<td>

√
√
√
√√

√
√</td>
<td>Plot a complete graph x against D

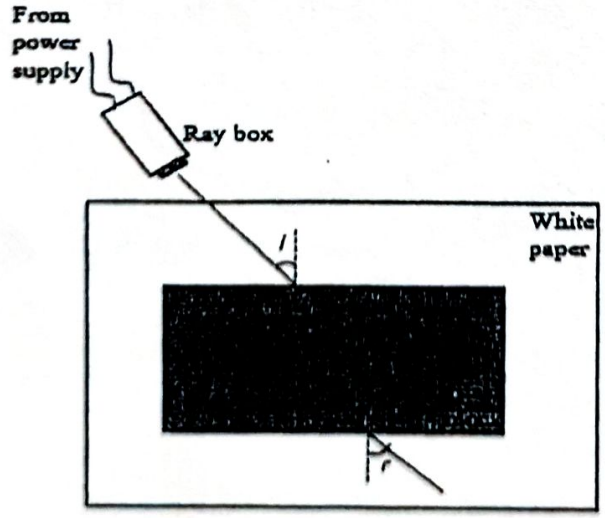
Tick (√) based on the following aspects:

A: Show D on the vertical axis and x on the horizontal axis
B: State the units of variables correctly
C: Both axes are marked with uniform scale
D: All five points are plotted correctly
(note: if only three points plotted correctly, award √)
E: Best fit straight line is drawn
F: Show the minimum size of graph at least 5 x 4 (2 cm x 2 cm) square (counted from the origin until the furthest point)

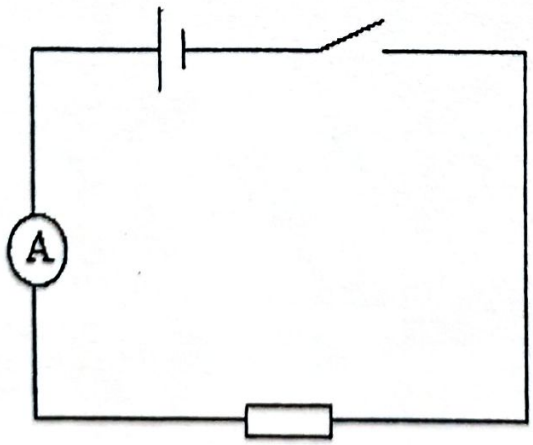
Score:
<table>
<tr><th>No of ticks</th><th>Score</th></tr>
<tr><td>7</td><td>5</td></tr>
<tr><td>5-6</td><td>4</td></tr>
<tr><td>3-4</td><td>3</td></tr>
<tr><td>2</td><td>2</td></tr>
<tr><td>1</td><td>1</td></tr>
</table>
</td>
</tr>
<tr>
<td>(e)</td>
<td>1</td>
<td>State the correct relationship between x and D
x is directly proportional to D</td>
</tr>
<tr>
<td>TOTAL</td>
<td>16</td>
<td></td>
</tr>
</table>

Question 2	Marks	Answer
(a)(i)	1	*Stating the correct relationship.* m is directly proportional to d
(ii)	1 1	**Determine the value of m correctly** Intrapolate and show on the graph Write on the space given, m = 53.0 g with correct unit **Reject : answer without unit**
(b) (i)	1 1 1	***Calculate the gradient, m of the graph*** Draw a sufficient large triangle (6 cm x 8 cm vertical) $k = \frac{(88.0 - 0)\ g}{(10 - 0)\ cm}$ $k = 8.8\ gcm^{-1}$ // $0.88\ kgm^{-1}$
(ii)	1 1	**Substitute the value of ρ *correctly*** $\rho = \frac{8.8}{7}$ // $\frac{0.88}{0.0007}$ Answer with correct unit $\rho = 1.2571\ gcm^{-3}$ //1257 kgm^{-3}// 1.2571 x10^{-3} kgm^{-3}
(c)	1 1 1	**Substitute the value of *V correctly*** $m = \rho V$ $V = \frac{80}{1.2571}$ $= 63.64\ cm^3$ **Answer with correct SI unit** $V = 63.64 \times (10^{-2})^3\ m^3$ $= 63.64 \times 10^{-6}\ m^3$ $= 6.364 \times 10^{-5}\ m^3$
(d)	1	***State the correct precaution*** Position of eye must be perpendicular to reading scale of meter rule // balance to avoid parallax error **Reject: not appropriate // without instrument**
TOTAL	**12**	

SECTION B

Question	Mark Scheme	Total Mark
3 (a)	**State a suitable inference** Refracted angle is influenced by incidence angle	1
(b)	**State a relevant hypothesis** The higher the incidence angle, the higher refracted angle	1
(c)	**Describe a complete and suitable experimental framework**	
(i)	**State the aim of the experiment** To investigate the relationship between incidence angle and refracted angle	1
(ii)	**State the manipulated variable and the responding variable** Manipulated Variable : Incidence angle, i	1
	Responding Variable : Refracted angle, r	1
	State the constant variable Constant Variable : Refractive index, n // density of glass block	1
(iii)	**State the complete list of apparatus and materials** Power supply, glass block, ray box, protractor, ruler, white paper, pencil	1
(iv)	**State a functional arrangement of the apparatus** 	1

(v)	**State the method to control the manipulated variable** The experiment was set up as in Diagram above. Switch on the power supply. The ray box was adjusted until the incidence angle is 10 °. **State the method to measure the responding variable** Refracted angle was measured using protactor and recorded. **Repeat the experiment at least 4 times** Experiment was repeated by using angle of 20 ° , 30 °, 40 ° and 50.°	1 1 1
(vi)	**State how the data is tabulated** Incidence angle, i/° | Refracted angle, r/° 10 | 20 | 30 | 40 | 50 |	1
(vii)	**State how the data is analysed** Refracted angle, r (°) Incidence angle,i (°)	1
	Total	**13** **Max** **:12**

Question	Mark Scheme	Total Mark
4 (a)	**State a suitable inference** The current is influenced by resistance // brightness of bulbs is depends on the number of bulbs	1
(b)	**State a relevant hypothesis** The higher resistance the higher the current	1
(c)	**Describe a complete and suitable experimental framework**	
(i)	**State the aim of the experiment** To investigate the relationship between resistance and current	1
(ii)	**State the manipulated variable and the responding variable** Manipulated Variable : Resistance , R	1
	Responding Variable : Current, I	1
	State the constant variable Constant Variable : Voltage // number of dry cell, V	1
(iii)	**State the complete list of apparatus and materials** Resistor, switch, ammeter, connecting wire, dry cell	1
(iv)	**State a functional arrangement of the apparatus**  	1

(v)	**State the method to control the manipulated variable** The experiment was set up. 2Ω resistor is connected to the circuit **State the method to measure the responding variable** Switch on the circuit. Current was measured using ammeter and recorded. **Repeat the experiment at least 4 times** Experiment was repeated by using 4Ω, 6Ω, 8Ω and 10 Ω resistor	1 1 1
(vi)	**State how the data is tabulated** R/ Ω | I/A 2 | 4 | 6 | 8 | 10 |	1
(vii)	**State how the data is analysed** I/A R/ Ω	1
	Total	**13** **Max: 12**

MAKTAB RENDAH SAINS MARA

PEPERIKSAAN AKHIR SIJIL PENDIDIKAN MRSM 2019

PERATURAN PEMARKAHAN

FIZIK

Kertas 1

Satu jam lima belas minit

4 5 3 1 1

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini SULIT dan Hak Cipta Bahagian Pendidikan Menengah MARA. Kegunaannya khusus untuk pemeriksa yang berkenaan sahaja. Sebarang maklumat dalam peraturan pemarkahan ini tidak boleh dimaklumkan kepada sesiapa.

Kertas soalan ini mengandungi 2 halaman bercetak.

MARKING SCHEME
SPMRSM PHYSICS 2019 (PAPER 1)

Number	Answer
1	C
2	B
3	D
4	A
5	B
6	C
7	D
8	B
9	C
10	A
11	C
12	D
13	C
14	A
15	D
16	B
17	B
18	D
19	B
20	A
21	B
22	D
23	A
24	B
25	D

Number	Answer
26	B
27	B
28	C
29	A
30	B
31	A
32	A
33	D
34	C
35	C
36	A
37	C
38	C
39	B
40	D
41	A
42	A
43	D
44	D
45	C
46	A
47	D
48	D
49	A
50	C

MAKTAB RENDAH SAINS MARA

PEPERIKSAAN AKHIR SIJIL PENDIDIKAN MRSM 2019

PERATURAN PEMARKAHAN

FIZIK

Kertas 2

Dua jam tiga puluh minit

4531/2

UNTUK KEGUNAAN PEMERIKSA SAHAJA

AMARAN

Peraturan pemarkahan ini SULIT dan Hak Cipta Bahagian Pendidikan Menengah MARA. Kegunaannya khusus untuk pemeriksa yang berkenaan sahaja. Sebarang maklumat dalam peraturan pemarkahan ini tidak boleh dimaklumkan kepada sesiapa.

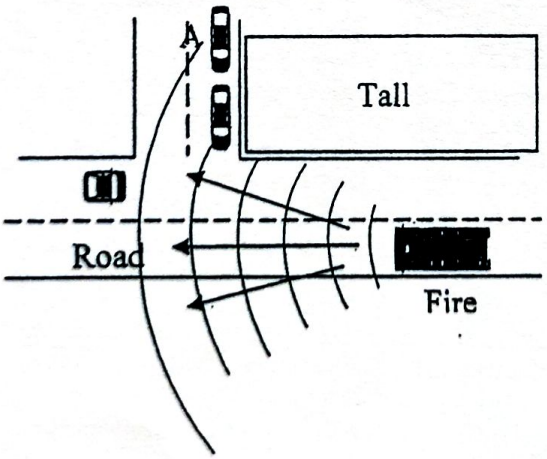
Kertas soalan ini mengandungi 12 halaman bercetak.

ANSWER SHEME PHYSICS PAPER 2
SPMRSM 2019

PAPER 2

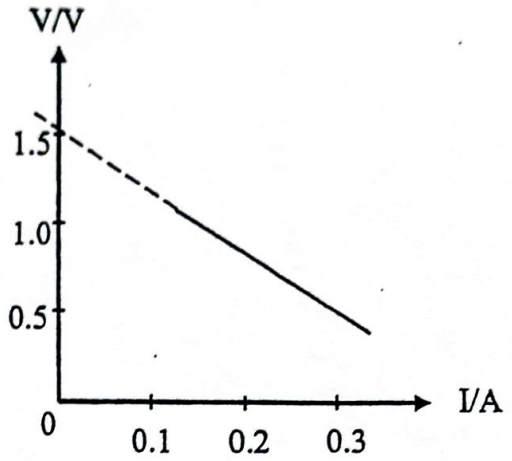
SECTION A

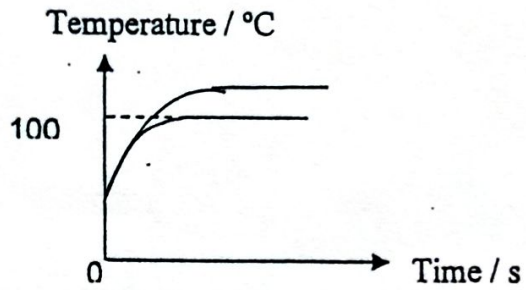
QUESTION NUMBER			ANSWER SCHEME	MARKS	REMARKS
1	(a)		*Give meaning of magnetic field correctly* Magnetic field is a region in which magnetic material experience a magnetic force	1	
	(b)	(i)	*Mark the direction of movement correctly* ⟶	1	
		(ii)	*State the law correctly* Fleming's Left Hand rule	1	
	(c)		*State one method to increase the motion correctly* Increase the magnitude of current// strength of magnet	1	
			TOTAL	**4 M**	
2	(a)		*State the type of zero error correctly* Positive zero error	1	
	(b)	(i)	*State the zero error correctly* +0.01 mm	1	
	(b)	(ii)	*Calculate the actual reading correctly* Actual Reading = 4.86mm – (+0.01) mm = 4.85 mm	1 1	Reject answer without unit.
	(c)		*Give the reason correctly.* To prevent extra pressure to the object	1	
			TOTAL	**5 M**	

3	(*a*)		*Give meaning of energy correctly* Ability to do work	 1	
	(*b*)	(i)	*State the change of energy correctly* Electrical energy → kinetic energy → gravitational potential energy	 1	
	(*b*)	(ii)	*Calculate the work done correctly* *W = mgh* *= 0.55kg x 10 x 20 m* *= 110 J*	 1 1	Reject answer without unit
	(*b*)	(iii)	*Calculate the efficiency correctly* η = Eo / Ei X 100% = 110 J / 200 J x 100% = 55%	 1 1	
			TOTAL	**6 M**	
4	(*a*)		*Name the phenomenon correctly* Diffraction of sound wave	 1	
	(*b*)		*Complete the wave pattern correctly*  *Correct pattern with 3 lines and show the direction of wave* *Wavelength before and after diffraction is the same*	 1 1	

	(c)		*Give reason correctly.* - wavelength ≥ Size of obstacle - Wave spread out more // diffraction more obvious	 1 1	
	(d)		*Calculate the wavelength correctly* $v = f\lambda$ $\lambda = \frac{v}{f}$ $= \frac{340\ \text{m/s}}{1500\text{Hz}}$ = 0.23 m /22.67 cm	 1 1	
			TOTAL	**7 M**	
5	(a)		*State the meaning of atmospheric pressure correctly* Pressure exerted by the weight of the atmosphere	 1	
	(b)	(i)	*Compare the altitude correctly* Altitude in diagram 5.2 > diagram 5.1	 1	
	(b)	(ii)	*Compare the density of air correctly* The density in diagram 5.1 > diagram 5.2	 1	
	(b)	(iii)	*Compare the atmospheric pressure correctly* The atmospheric pressure in diagram 5.1 > diagram 5.2	 1	
	(c)	(i)	*State the relationship between density of air and the altitude correctly* When the altitude is increases, the density of air is decreases	 1	
	(c)	(ii)	*State the relationship between altitude and atmospheric pressure correctly* When the altitude is increases, the atmospheric pressure is decreases	 1	
	(d)		*Give reason why it colder at the top of the mountain than it is at sea level correctly* When the altitude is increases, the atmospheric pressure is decreases. When the atmospheric pressure decreases, the temperature at the top mountain decreases.	 1 1	
			TOTAL	**8 M**	

6	(a)		*State the meaning correctly* Spontaneous disintegration of an unstable nucleus (to become stable) accompanied by the emission of energetic particles or photons.	1	
	(b)	(i)	*Compare the strength of electric field correctly.* Both Diagram have the same strength of electric field	1	
	(b)	(ii)	*Compare the charge correctly.* Diagram 6.1 has positive charge while Diagram 6.2 has negative charge	1	
	(b)	(iii)	*Compare the size deflection correctly.* Diagram 6.1 has smaller deflection than Diagram 6.2	1	
	(b)	(iv)	*Compare the mass correctly.* Diagram 6.1 has greater mass than Diagram 6.2	1	
	(b)	(v)	*Relate the mass and the size of deflection correctly.* When the mass is increases , the deflection is smaller	1	
	(c)	(i)	*State method correctly.* increases potential difference // use higher EHT // decrease the distance between the plates	1	
	(c)	(ii)	*Give reason correctly* can increases the strength of electric field	1	
			TOTAL	**8 M**	
7	(a)		*State the physical quantity measured by the voltmeter correctly* Potential difference // voltage	1	

	(b)	(i)	*Determine the voltage from the graph when the current is zero correctly.*  Draw the line correctly – 1M Answer =1.5 V – 1 M	2	
		(ii)	*State the physical quantity represent by answer in 7(b) (i) correctly* Electromotive force (e.m.f)	1	
	(c)	(i)	*State the modification and reason correctly* Voltage used: Higher // bigger *Reason* More power / More energy	1 1	
		(ii)	*State the modification and reason correctly* Internal resistance of the battery: Smaller *Reason* More current / high voltage	1 1	
		(iii)	*State the modification and reason correctly* Type of battery used : Rechargeable // lithium battery *Reason* Long lasting // save cost	1 1	
			TOTAL	**10 M**	

8	(a)	(i)	*State the boiling point correctly.* 100^0 C	 1	
	(a)	(ii)	*Sketch the graph correctly.*  	 1 1	• shape • above 100^0C
	(a)	(iii)	*Give reason correctly.* More energy needed to break the bond between particles	 1	
	(b)		*State the meaning correctly.* The change of the physical state of matter from gas phase into the liquid phase	 1	
	(c)	(i)	*Calculate the specific latent heat correctly* $l = \frac{Q}{m}$ $l_K = \frac{54\ J}{0.25\ kg}$ $= 216\ J\ kg^{-1}$ $l_L = 328\ J\ kg^{-1}$ $l_M = 800\ J\ kg^{-1}$	 1 1 1 1	Substitution a.w.u a.w.u a.w.u
	(c)	(ii)	*State the suitable boiling point correctly.* Low boiling point Easy to change to vapour state	 1 1	
	(c)	(iii)	*State the most suitable refrigerant correctly.* K	 1	
			TOTAL	**12 M**	

SECTION B

9	(a)		*State the definition correctly* Image cannot be form on the screen	 1	
	(b)		*State the comparison correctly* The object distant in Diagram 9.2 > Diagram 9.1 The angle of incident Diagram 9.1 > Diagram 9.2	 1 1	
	(c)	(i)	*State the relationship between angle of incident & object distance correctly* The angle of incident increases , the object distance decreases	 1	
		(ii)	*State the relationship between angle of incident & angle of reflection correctly* The angle of incident increases = the angle of reflection	 1	
	(d)		*Name the law correctly* Law of reflection	 1	
	(e)		*Explain the phenomenon correctly* *State the light is from denser medium* - light travels from dense to a less dense medium *State the i > c* - i > c *State that total internal reflection occur* - Total internal reflection occurs *State the light is reflected* - The light rays reflects internally in the water	 1 1 1 1	

	(f)		*State the suitable modification and justifications correctly* **Characteristics /aspects** / **Explanation** 2 prism / 4 prism — To produce total internal reflection — 2 Big diameter of objective lens — More light enter — 2 High power of eye lens — Magnified the image — 2 Low power of objective lens — High focal point/can detect further object — 2 Low density of material — Low mass/lighter — 2 Prism angle 60^0 — Total internal reflection occur — 2		Prefer answer in table **Max : 10 M**
			TOTAL	**20 M**	
10	(a)		*Name the type of transistor correctly* npn transistor	1	
	(b)	(i)	*Compare microammeter reading correctly* The microammeter reading in Diagram 10.2 is greater/bigger than in Diagram 10.1	1	
		(ii)	*Compare miliammeter reading correctly* The miliammeter reading in Diagram 10.2 is greater/bigger than in Diagram 10.1	1	
		(iii)	*Compare the I_b and I_c correctly* Collector current is greater/bigger than base current in both diagram	1	
	(c)		*State the relationship between I_b and I_c correctly* The greater the base current, the greater the collector current *State the formula correctly* current amplification = $\frac{I_c}{I_b}$	1 1	

<table>
<tr><td></td><td>(d)</td><td></td><td>Explain how the galvanometer shows reading correctly
• Sound change to electrical current in microphone
• Current flow through base
• Transistor will on
• More current flow in collector/speaker
• Produce bigger sound
• Capacitor stabilize the current flow through base</td><td>1
1
1
1
1
1</td><td>Max 4 marks</td></tr>
<tr><td></td><td>(e)</td><td>(i)</td><td>States the suitable modification and the explanations correctly
<table>
<tr><th>Modification</th><th>Reason</th></tr>
<tr><td>Replace LDR with thermistor</td><td>To detect heat when temperature is high</td></tr>
<tr><td>Replaced bulb with relay</td><td>To switch on the secondary circuit</td></tr>
<tr><td>Add motor in the secondary circuit</td><td>To switch on the sprinkler</td></tr>
<tr><td>Use 240 V power supply</td><td>To switch on the motor</td></tr>
</table></td><td>2
2
2
2</td><td>Answers assisted by diagram with explanation is accepted.</td></tr>
<tr><td></td><td>(e)</td><td>(ii)</td><td>Name the logic gate and symbol correctly
AND gate
  </td><td>1
1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>TOTAL</td><td>20 M</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

SECTION C

11	(a)		*State the meaning velocity correctly* The rate of change of displacement	1	
	(b)		*Explain how the phenomenon occurs correctly* • By moving the hand backwards when swing the ball, velocity increases • High gravitational potential energy // high kinetic energy • Change of momentum increases • Time of impact decreases • Impulsive force will increase.	1 1 1 1 1	**Max 4**
	(c)	(i)	*Calculate the impuls correctly* Ft= mv-mu = 0.15(60)-0.15(0) = 9 Ns	1 1	
	(c)	(ii)	*Calculate the impulsive force correctly* F = mv-mu/t F = 9 /($5x10^{-3}$) =1800 N *the conversion of time in the substitution 1M	1 1 1	substitution a.w.u
	(d)		*States the suitable characteristics and the explanations*		

Characteristics	Reason	
Carbon fibre	Lighter// not easily break //low mass//strong	2
Low density	Low mass//lighter//easy to carry//	2
Hard foam	Easy to stop the ball//absorb impulsive force//short time interval	2
Thicker	Increase time impact// reduce impulsive force	2
1 choose M		1
Because it has carbon fibre, low density , hard foam and thicker		1

			TOTAL	20 M	
12	(a)	(i)	*State the electrical device correctly* Step down transformer	1	
	(a)	(ii)	*Explain how electrical device work correctly.* Alternating current (ac) is supply / flow to primary coil of transformer. Changing magnetic field is produce. Soft iron core link the changing of magnetic flux to secondary coil Induced emf produced in secondary coil// Smaller output voltage produced in secondary coil	1 1 1 1 1	**Max 4**
	(b)	(i)	*Calculate output current correctly* P = IV 702 = I x 220 I = 3.19 A	1 1	• Subsitution • Answer with unit
		(ii)	*Calculate the input power correctly.* η = Po / P_{in} x 100% 90 % = 702 / P_{in} x 100% P_{in} = 702 / 0.9 P_{in} = 780 W	1 1	• Subsitution • Answer with Unit
		(iii)	*Calculate the power loss correctly.* Power loss = Pin – Pout = 780 – 702 = 78 W	1	• Answer with Unit

	(c)		*States the suitable characteristics and the explanations*		

Characteristics	Reason	
1. High number of turns of wire	2. More induced current is generated/ produce	2
3. More number of magnet	4. More power generated / more induced current generated	2
5. Large ability to store energy	6. Can store more charge / can be used for longer time	2
7. Type of bulb : LED	8. Less power consumption// less power use // more brighter	2
9. O is chosen		1
10. Because High number of turns of wire, more number of magnet, large ability to store energy and LED bulb.		1

			TOTAL	**20 M**	