



**MAKTAB RENDAH SAINS MARA**

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**PEPERIKSAAN AKHIR SIJIL PENDIDIKAN MRSM 2021**

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**PERATURAN PEMARKAHAN FIZIK**

**Kertas 1**

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Number	Answer		Number	Answer
1	<b>A</b>		21	<b>D</b>
2	<b>A</b>		22	<b>B</b>
3	<b>A</b>		23	<b>C</b>
4	<b>B</b>		24	<b>C</b>
5	<b>A</b>		25	<b>A</b>
6	<b>D</b>		26	<b>C</b>
7	<b>D</b>		27	<b>D</b>
8	<b>C</b>		28	<b>D</b>
9	<b>D</b>		29	<b>C</b>
10	<b>C</b>		30	<b>D</b>
11	<b>B</b>		31	<b>C</b>
12	<b>A</b>		32	<b>D</b>
13	<b>C</b>		33	<b>B</b>
14	<b>A</b>		34	<b>C</b>
15	<b>A</b>		35	<b>B</b>
16	<b>B</b>		36	<b>C</b>
17	<b>B</b>		37	<b>D</b>
18	<b>B</b>		38	<b>D</b>
19	<b>A</b>		39	<b>C</b>
20	<b>B</b>		40	<b>B</b>

**Taburan Jawapan**

Jawapan	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
Bilangan	<b>9</b>	<b>10</b>	<b>11</b>	<b>10</b>
Jumlah	<b>40</b>			



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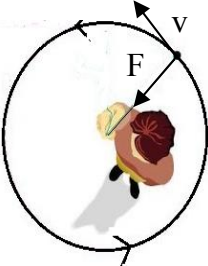
**PERATURAN PEMARKAHAN FIZIK**

**Kertas 2**

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SECTION A

NO	SUGGESTED ANSWER	MARK
<b>1</b>	(a) <i>State the force correctly</i> Centripetal force	1
	(b) (i) <i>Mark the direction of force, F correctly</i>	1
		
	(ii) <i>State one factor that affect speed, v correctly</i> Radius of the circle//mass of the object	1
	(c) <i>State the answer correctly</i> Move in straight line (in direction) of <b>tangent</b> (to its circular path) // Moves <b>perpendicular</b> // <b>tangently</b> to the circular motion at the breaking point	1
<b>TOTAL 4</b>		
<b>2</b>	(a) <i>State the of nuclear reaction correctly</i> Nuclear Fission	1
	(b) (i) <i>Name the reaction process correctly</i> Chain reaction	1
	(ii) <i>State the condition need to be fulfilled correctly</i> The mass of radioactive source/Uranium-235 must be <b>greater</b> than / <b>exceed</b> its critical mass	1
	(c) <i>Calculate the value of X and Y correctly</i> $235 + 1 = X + 92 + 3$ $X = 141$	1
	$92+0 = 56 + Y + 3(0)$ $Y = 36$	1
<b>TOTAL 5</b>		

3	(a)	<b>State the meaning of momentum correctly</b>  (Momentum of an object is) product of mass and velocity.	1	
	(b)	(i)	<b>Determine the total momentum correctly</b>  Total momentum before explosion $p = (m_1 + m_2) u$ $p = (250 \text{ kg} + 50 \text{ kg}) (0 \text{ m s}^{-1})$ $p = 0 \text{ kg m s}^{-1} // 0 // \text{Zero}$	1
		(ii)	<b>Calculate the velocity, <math>v_1</math> correctly</b>  Velocity $v_1$ of the rocket $m_1 v_1 + m_2 v_2 = 0$ $50 v_1 + (250 \text{ kg}) (-3.5 \text{ m s}^{-1}) = 0$ $v_1 = 17.5 \text{ m s}^{-1}$	1 1
	(c)	<b>State the physics principle correctly</b>  (Principle of) Conservation of Momentum	1	
	(d)	<b>State the modification correctly</b>  <i>Accept any suitable answer</i>  Reduce the mass of human cannon ball // Use angle of cannon $45^\circ$ // decreases angle of cannon // Increases the mass of cannon	1	
			<b>TOTAL 6</b>	
4	(a)	<b>Name the type of transistor correctly</b>  NPN // npn	1	
	(b)	<b>Tick the function of the relay switch correctly</b>  <input type="checkbox"/> $\sqrt$ To switch on the secondary circuit	1	
	(c)	(i)	<b>Calculate the potential difference across the thermistor correctly</b>  $6\text{V} - 4\text{V} = 2\text{V}$	1
(ii)		<b>Calculate the minimum resistance of thermistor correctly</b>  <i>Show the correct substitution and answer with correct unit</i>  $4 = \frac{7000}{(7000 + R_T)} (6)$  $R_T = 3500 \Omega$  <b>Or</b>	1 1	

		$2 = \frac{R_T}{(7000 + R_T)} (6)$ $= 3\,500 \, \Omega$	1 1
	(d)	<p>(i) <b>Calculate the gradient of the graph correctly</b></p> <p>Correct substitution and answer with no unit</p> <p>Gradient = <math>\frac{(62 \times 10^{-3}) - 0}{(0.4 \times 10^{-3}) - 0}</math>      <b>Reject:</b> <math>\frac{62}{0.4}</math></p> <p>= 155</p>	1 1
		<p>(ii) <b>State the physical quantity correctly</b></p> <p>Amplification factor // <math>\beta</math>      <b>Reject: Amplification only</b></p>	1
	(e)	<p><b>State another function of transistor correctly</b></p> <p>Current // sound amplifier</p>	1
			<b>TOTAL 9</b>
5	(a)	<p><b>State the correct physical quantity</b></p> <p style="text-align: center;"><span style="border: 1px solid black; padding: 2px 10px;">/</span> gas pressure</p>	1
	(b)	<p>(i) <b>Compare the volume of gas correctly</b></p> <p>Volume of gas in diagram 5.1 bigger// &gt; than diagram 5.2</p>	1
		<p>(ii) <b>Compare the reading of Bourdon Gauge correctly</b></p> <p>The reading of Bourdon Gauge in diagram 5.1 smaller // &lt; than diagram 5.2</p>	1
		<p>(iii) <b>Compare the number of particles correctly</b></p> <p>Same / unchanged // constant // uniform</p>	1
	(c)	<p>(i) <b>State the relationship between volume and reading of Bourdon Gauge correctly</b></p> <p>As the volume of the gas increases, the reading of Bourdon Gauge decreases vice versa</p>	1
		<p>(ii) <b>State the physics law correctly</b></p> <p>Boyle's (Law)</p>	1

	(iii)	<b>State the molecular kinetic theory correctly</b>  M <sub>1</sub> - When the volume of the gas decreases, the number of molecules per unit volume increases M <sub>2</sub> - Rate of collision between gas molecules and the wall increases. M <sub>3</sub> - Force per unit area on the wall of container increases (As such the gas pressure increases)	Max 2	
	(d)	<b>State the answer correctly</b>  Unchanged // same	1	
			<b>TOTAL 9</b>	
6	(a)	<b>State the meaning of the magnetic field correctly</b>  Magnetic field is a region at which magnetic materials experience force	1	
	(b)	(i)	<b>Compare the number of turns of the solenoid correctly</b>  Number of turns in diagram 6.1 and 6.2 are same	1
		(ii)	<b>Compare the polarity of magnet that enter the solenoid correctly</b>  The pole of magnet that enter the solenoid in diagram 6.1 is South / S while diagram 6.2 is North / N	1
		(iii)	<b>Compare the direction of deflection of galvanometer pointer correctly</b>  The direction of deflection of galvanometer pointer in diagram 6.1 is to the right while diagram 6.2 is to the left	1
	(c)	<b>Relate the polarity of magnet that enter the solenoid to the direction of deflection of galvanometer pointer correctly</b>  When the polarity of magnet that enter the solenoid is South, the deflection of galvanometer pointer is to the right // vice versa	1	
	(d)	(i)	<b>State the polarity at X correctly</b>  X = South // S	1
		(ii)	<b>Name the law correctly</b>  Lenz's Law	1
	(e)	<b>State deflection of galvanometer pointer correctly</b>  It deflects more // greater // increase	1	

		<b><i>Explain the answer correctly</i></b> Because the velocity is higher // cutting of magnetic flux higher	1
			<b>TOTAL 9</b>
7	(a)	<b><i>State the meaning of focal length correctly</i></b> <i>Distance between focal point and optical centre (of lens) // Distance between focal point and centre of the lens // show and label in diagram</i>	1
	(b)	(i) <b><i>Complete the ray diagram correctly</i></b> M1 - Line parallel principle axis bending through F & Straight line from object pass through optical centre of the lens M3 - Show / draw an image at correct position (intercept)	1 1
		(ii) <b><i>State any one correct characteristic of image formed</i></b> Real // inverted // magnified	1
	(c)	(i) <b><i>State the correct characteristic of the focal length</i></b> Longer // bigger // more // higher <b><i>State the correct reason</i></b> High magnification // bigger / larger image	1 1
		(ii) <b><i>State the correct diameter</i></b> Bigger // greater // more // larger <b><i>State the correct reason</i></b> Brighter // allow more light enter the lens / clearer	1 1
		<b>Reject: Sharp Image</b>	



	(d)	<i>State the correct choice</i> S	1	
			<b>TOTAL 9</b>	
<b>8</b>	(a)	<i>Name the physics law correctly</i> Hooke's (Law)	1	
	(b)	<i>State what happen to the spring correctly</i> Spring cannot return to its original length or size // Spring loss its elasticity / length becomes longer // spring distorted // spring deformed <b>Reject: Spring damage / broken</b> <i>State reason correctly</i> Exceed elastic limit	1 1	
	(c)	(i)	<i>State the thickness of wire correctly</i> Thicker / greater <i>State reason correctly</i> Greater spring constant / Stiffer / High elastic limit / can withstand high force	1 1
		(ii)	<i>State number of spring correctly</i> More / higher <i>State reason correctly</i> Greater spring constant / Stiffer / higher elastic limit / extension smaller / less elastic	1 1
		(iii)	<i>State arrangement of spring correctly</i> Parallel <i>State reason correctly</i> Greater spring constant/ Stiffer/higher elastic limit/less elastic	1 1
			<b>Note for 8(c): Different reason for (i), (ii) and (iii)</b>	
				<b>TOTAL 9</b>

**SECTION B**

NO	SUGGESTED ANSWER	MARK																			
<b>9</b>	<p>(a) <i>State the definition correctly</i></p> <p><b>Line that joints all</b> antinodes point / all constructive interference points / crest meet crest / trough meet trough.</p>	1																			
	<p>(b) <i>Describe correct movement of the cork</i></p> <p><b>M1</b> Position at maximum/top/highest amplitude/highest displacement</p> <p><b>M2</b> Point P at constructive interference</p> <p><b>M3</b> Crest meets crest     <b>Reject: Trough meets trough</b></p> <p><b>M4</b> Amplitude of the wave is at maximum</p> <p><b>M5</b> Highest energy</p>	Max 4																			
	<p>(c) <i>Explain the suitable characteristics correctly</i></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 25%;">Aspect</th> <th style="width: 25%;">Characteristic</th> <th style="width: 50%;">Explanation</th> </tr> </thead> <tbody> <tr> <td>Distance between speakers</td> <td><b>M1</b> Large / far</td> <td><b>M2</b> Distance between consecutive loud sound produced is smaller</td> </tr> <tr> <td>Diameter of the speaker</td> <td><b>M3</b> big / large</td> <td><b>M4</b> spread wider, higher amplitude/more air molecules can be compressed.</td> </tr> <tr> <td rowspan="3">Frequency of the sound wave from speaker</td> <td><b>M5</b> low / small</td> <td><b>M6</b> high wavelength, diffraction more.</td> </tr> <tr> <td colspan="2" style="text-align: center;"><b>Either one with correct reason</b></td> </tr> <tr> <td><b>M5</b> high / greater/ more</td> <td><b>M6</b> High energy, travel far</td> </tr> <tr> <td>No of speakers</td> <td><b>M7</b> more</td> <td><b>M8</b> louder sound, travel far, propagate to many directions</td> </tr> </tbody> </table> <p><i>Choose the correct set up</i></p> <p>L</p> <p><i>State all the reasons correctly</i></p> <p>State all the aspects and characteristics as in the table above correctly</p>	Aspect	Characteristic	Explanation	Distance between speakers	<b>M1</b> Large / far	<b>M2</b> Distance between consecutive loud sound produced is smaller	Diameter of the speaker	<b>M3</b> big / large	<b>M4</b> spread wider, higher amplitude/more air molecules can be compressed.	Frequency of the sound wave from speaker	<b>M5</b> low / small	<b>M6</b> high wavelength, diffraction more.	<b>Either one with correct reason</b>		<b>M5</b> high / greater/ more	<b>M6</b> High energy, travel far	No of speakers	<b>M7</b> more	<b>M8</b> louder sound, travel far, propagate to many directions	<p>Max 8</p> <p>1</p> <p>1</p>
Aspect	Characteristic	Explanation																			
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	(d)	(i)	<p><b>Correct conversion of wavelength and distance between two slits</b></p> <p><math>600 \times 10^{-9} \text{ m}</math> and <math>0.5 \times 10^{-3} \text{ m}</math></p> <p><b>Correct substitution</b></p> $x = \frac{(600 \times 10^{-9} \text{ m})(2.5 \text{ m})}{(0.5 \times 10^{-3} \text{ m})}$ <p><b>Answer with correct unit</b></p> <p><math>3.0 \times 10^{-3} \text{ m}</math></p>	1  1  1									
		(ii)	<p><b>Correct substitution</b></p> $AB = (3.0 \times 10^{-3} \text{ m}) \times 5$ <p><b>Answer with correct unit</b></p> <p><math>15 \times 10^{-3} \text{ m} / 1.5 \text{ cm}</math></p>	e.c.f. from 9 (d)(i) 1  1									
				<b>TOTAL 20</b>									
<b>10</b>	(a)	<p><b>State the definition correctly</b></p> <p>Power is the amount of energy transferred per second // rate of energy transferred / work done</p>		1									
	(b)	<p><b>Explain how hot air is generated and circulated correctly</b></p> <p>(When switch is on), heat is generated by the heating element (that is situated at the top of the chamber)</p> <p>The (radiant) heat released by the heating element is very high.</p> <p>The (blower) fan circulates the hot air // The (blower) fan push hot air around the fryer.</p> <p>The hot air is blown in all direction by the fan (results in cooking the food quicker)</p>		1  1  1  1									
	(c)	<p><b>Explain the suitable characteristics correctly</b></p> <table border="1"> <thead> <tr> <th>Aspect</th> <th>Characteristic</th> <th>Explanation</th> </tr> </thead> <tbody> <tr> <td>Power</td> <td><b>M1</b> High</td> <td><b>M2</b> To produce more electrical energy per second // Release more heat</td> </tr> <tr> <td>Materials of Heater</td> <td><b>M3</b> Nichrome</td> <td><b>M4</b> Has high resistance // high resistivity // Produce more heat // High melting point</td> </tr> </tbody> </table>		Aspect	Characteristic	Explanation	Power	<b>M1</b> High	<b>M2</b> To produce more electrical energy per second // Release more heat	Materials of Heater	<b>M3</b> Nichrome	<b>M4</b> Has high resistance // high resistivity // Produce more heat // High melting point	
Aspect	Characteristic	Explanation											
Power	<b>M1</b> High	<b>M2</b> To produce more electrical energy per second // Release more heat											
Materials of Heater	<b>M3</b> Nichrome	<b>M4</b> Has high resistance // high resistivity // Produce more heat // High melting point											

		<p>Melting point of heater</p> <p>Electronic component</p>	<p><b>M5</b> High</p> <p><b>M6</b> Thermostat</p>	<p><b>M6</b> Withstand high temperature // Not easy to melt</p> <p><b>M7</b> Can control Heat / Temperature</p>	<p>Max 8</p>
		<p><b>Choose the correct air fryer</b></p> <p>X</p> <p><b>State all the reasons correctly</b></p> <p>State all the aspects and characteristics as in the table above correctly</p>			<p>1</p> <p>1</p>
	(d)	(i)	<p>Current, <math>I = P/V</math></p> <p><math>= 1\,450 / 240</math></p> <p><math>= 6.04\text{ A} // 6.042\text{ A} // 6.0417\text{ A} \#</math></p> <p>(Acceptable Range : 6.040 A – 6.042 A)</p>		<p>1</p>
		(ii)	<p>Electrical energy, <math>E = Pt = VIt</math></p> <p><math>= (1\,450) \times (10 \times 60) = 240 \times 6.042 \times (10 \times 60)</math></p> <p><math>= 8.7 \times 10^5\text{ J} \#</math></p>		<p>1</p> <p>1</p>
		(iii)	<p>Power loss, <math>P = I^2 R</math></p> <p><math>= (6.042)^2 \times (38)</math></p> <p><math>= (36.506) \times (38)</math></p> <p><math>= 1\,370.13\text{ W} \#</math></p> <p>(Acceptable Range : 1 370.13 W – 1 386.30 W)</p>		<p>1</p> <p>1</p>
					<b>TOTAL 20</b>

**SECTION C**

NO	SUGGESTED ANSWER	MARK						
11	<p>(a) <b><i>State the meaning of buoyant force correctly</i></b></p> <p>Buoyant force is the force acting upwards on an object immersed in fluid when there is pressure difference between the lower surface and upper surface of the object.  <b>Reject: Incomplete sentence</b></p>	1						
	<p>(b) <b><i>Compare the weight, depth immersed and volume of water displaced by the cruise ships correctly</i></b></p> <p>The weight in diagram 11.1 is lower than diagram 11.2 // vice versa</p> <p>The depth immersed in diagram 11.1 is lower than diagram 11.2 // vice versa</p> <p>The volume of water displaced by the cruise ship in diagram 11.1 is lower than diagram 11.2 // vice versa</p> <p><b><i>Relate weight of the cruise with the depth immersed correctly</i></b></p> <p>The higher the weight of the cruise the higher the depth immersed // vice versa</p> <p><b><i>State the deduction correctly</i></b></p> <p>The higher the weight of the ship the higher the buoyant force //  The weight of cruise ship is equal to the buoyant force</p>	1 1 1 1 1						
	<p>(c) <b><i>Explain the paraglider can increase and decrease the altitude correctly</i></b></p> <p><b><u>To increase the altitude (Bernoulli's Principle)</u></b>  When paragliding moves, the canopy inflates/ flatten/wider/open  The velocity of air above paraglider is higher producing low pressure // vice versa  The difference in pressure, produce lift force</p> <p><b><u>To decrease the altitude</u></b>  Pull the string, the canopy become curve.  Weight of air displaced decreases  Lift force &lt; weight of paraglider // Weight &gt; buoyant force</p>	<b>Any Two</b> 1 1 1  <b>Any Two</b> 1 1 1  Max 4						
	<p>(d) <b><i>Explain the suggestion correctly</i></b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Characteristics</th> <th style="text-align: center;">Explanation</th> </tr> </thead> <tbody> <tr> <td>Shape of the wing Aerofoil</td> <td>To produce lift force</td> </tr> <tr> <td>Area / size of the wing is large</td> <td>To produce larger lift force</td> </tr> </tbody> </table>	Characteristics	Explanation	Shape of the wing Aerofoil	To produce lift force	Area / size of the wing is large	To produce larger lift force	2 2
Characteristics	Explanation							
Shape of the wing Aerofoil	To produce lift force							
Area / size of the wing is large	To produce larger lift force							

	Water resistant // Coated with resin (anything to repel water)	The wing does not absorb moisture // keep the wings dry	2
	Made from strong material	Durable // not easy to break	2
	Titanium // (specific) aluminium alloy	Strong // lighter	2
	Stiffer	Not easy to change the shape	2
	Density of the wing is low	Lighter // Small mass	2
	Surface of the wings is smooth	To reduce air resistance	2
	<b>Accept reasonable answer</b>		Max 10
			<b>TOTAL 20</b>