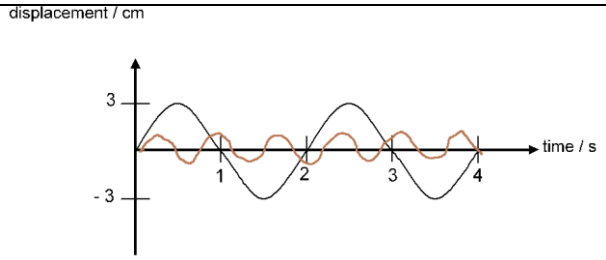
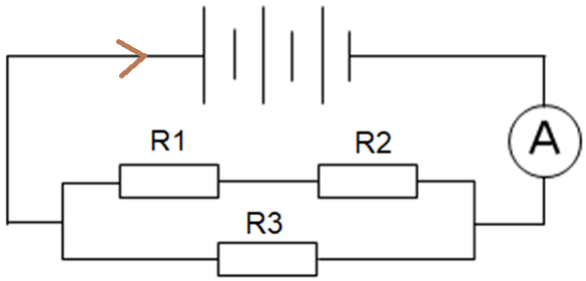
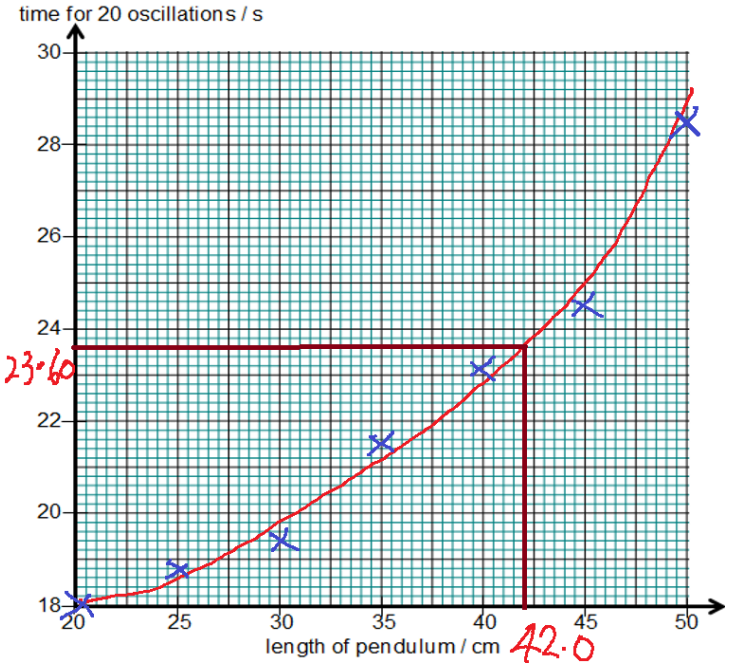
2021 Preliminary Examination Sec 4NA Answer Scheme and Examiners Report

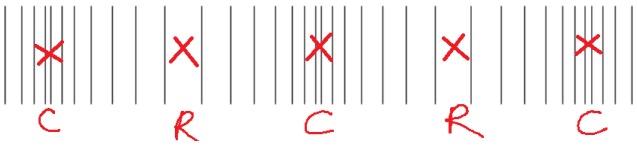
Paper 1:

1	2	3	4	5	6	7	8	9	10
C	**D**	**C**	**D**	**D**	**C**	**C**	**C**	**D**	**B**
11	12	13	14	15	16	17	18	19	20
B	**B**	**D**	**D**	**B**	**A**	**B**	**B**	**C**	**A**

Paper 2:

Qn	Answer	Marks	Remarks
1a	Pressure at larger piston is equal to the pressure at smaller piston. Since <u>area at larger piston is larger than cross sectional area at smaller piston, force at larger piston is greater than force at smaller piston</u>.	B1 B1	Common errors include not using the keyword cross sectional area (given in this context) and used surface area instead.
1b	Molecules <u>move faster</u> / <u>move at higher speeds</u> and <u>kinetic energy increases</u>.	B1	Need comparison move at higher speeds. Move at high speeds will not be accepted. Common error was vibrate more vigorously: this is incorrect as vibration is for solid molecules and not liquid molecules.
2a	Electrical energy used = ((31 – 23) / 2) x 10 = 40 MJ	B1 B1	Need to calculate the correct temperature difference (31 – 23)°C and multiply it by 10 MJ/2°C to obtain the energy used
2b	Average temperature (air conditioner A) = (21 + 25 + 23 + 23 + 20 + 25 + 22) / 7 = 22.7 Average temperature (air conditioner B) = (22 + 23 + 20 + 25 + 24 + 24 + 20) / 7 = 22.6 Better to use Air conditioner B.	 B1	Need to use the data to calculate the average temperature of A and B to compare.
3a	period = 2 s	B1	Generally well done.
3b	frequency = 1 /period = ½ = 0.5 Hz	 B1	Some students used speed = frequency x wavelength to find frequency. However speed and wavelength are not given.

3c	 1 mark for smaller amplitude 1 mark for higher frequency	B1 B1	Generally well done. Common errors - Not drawing on the given diagram (stated in question) but drawing a new diagram - drawing a new diagram but not indicating the values on the diagram
4a		B1	Poorly done. Electron flow is from negative terminal to positive terminal (shorter end of cell to longer end of cell)
4b	1/ R (eff) = 1/6 + 1/3 = 3/6 R (eff) = 6/3 = 2 Ω	M1 A1	Some students used the formula for all three resistors in parallel. This is incorrect as R1 and R2 are in series with each other and not in parallel.
4c	There is a <u>short circuit</u> or <u>effective resistance decreases to zero</u> causing a large current to flow.	B1	Poorly done. Incorrect responses included stating current does not flow through the resistors Keywords “short circuit” or “effective resistance is zero” must be stated.
5ai	 1 mark for plotted points 1 mark for curve of best fit	B1 B1	Common error include drawing a straight line. Trend of data is a curve (equal number of points above and below the curve)
5aii	23.60 s	B1	Generally well done. Need to read graph to nearest half division.

<table>
<tr><td>5bi</td><td>GPE = mgh
0.15 = 0.2 x 10 x h
h = 0.075 m</td><td>M1
A1</td><td>Generally well done.</td></tr>
<tr><td>5bii</td><td>KE = ½ mv^2
= ½ x 0.2 x 1.1^2
= 0.121 J</td><td>M1
A1</td><td>Generally well done.</td></tr>
<tr><td>5biii</td><td><u>Energy at Q (0.121 J) is less than energy at P (0.15 J)
Thus energy has been converted to thermal and sound energy.</u></td><td>B1</td><td>Poorly done. Need to compare the energy before and after. Since there is a difference in the energy, there is energy converted to thermal and sound energy.</td></tr>
<tr><td>6a</td><td> 

Any 1 correct C with cross (X)
Any 1 correct R with cross (X)</td><td>

B1
B1</td><td>Cross must be marked at the centre (between 2 lines).</td></tr>
<tr><td>6b</td><td>wavelength = 6.2 cm</td><td>B1</td><td>Distance between 2 compressions or distance between 2 rarefactions</td></tr>
<tr><td>6c</td><td>speed = frequency x wavelength
= 75 800 x 6.2
= 447 220 cm/s</td><td>M1
A1</td><td>Generally well done.</td></tr>
<tr><td>6d</td><td>Sound is a longitudinal wave but electromagnetic wave is a transverse wave.
Sound needs a medium to travel but electromagnetic waves can travel through a vacuum.
Sound wave travels slower in air than electromagnetic waves.

Any one difference correct – 1 mark</td><td>B1</td><td>Generally well done.</td></tr>
<tr><td>6e</td><td><table><tr><td>distance /m</td><td>time /s</td></tr><tr><td>1500</td><td></td></tr><tr><td>1600</td><td></td></tr><tr><td>1700</td><td></td></tr><tr><td>1800</td><td></td></tr><tr><td>1900</td><td></td></tr><tr><td>2000</td><td></td></tr></table>
1m – headings with units
1m – 6 rows with values of distance</td><td>B1
B1</td><td>Generally well done.

Common error was omitting the units m or s in the heading.</td></tr>
<tr><td>7a</td><td><table><tr><td></td><td>name of wire</td><td>colour of insulation</td></tr><tr><td>wire A</td><td>Earth wire</td><td>yellow & green</td></tr><tr><td>wire B</td><td>Neutral wire</td><td>blue</td></tr></table></td><td></td><td></td></tr>
</table>

	wire **C** | Live Wire | brown One correct – 0 mark Two correct – 1 mark Three correct – 1 mark All correct – 2 mark	B1 B1	
7b	Fuse. Melt and break the circuit if current exceeds fuse rating.	B1 B1	
7c	Earth Wire. In electrical fault if Live wire touches the metal case, current will flow through Earth wire instead of user preventing electric shock.	B1	
7d	Overloading of current leading to electrical fire.	B1	
7e	I = Q / t = 810 / (3 x 60) = 4.5 A P = VI = 240 x 4.5 = 1080 W	M1 A1	