2022 Prelim 4NA Sci (Phy) Suggested Answers

Paper 1

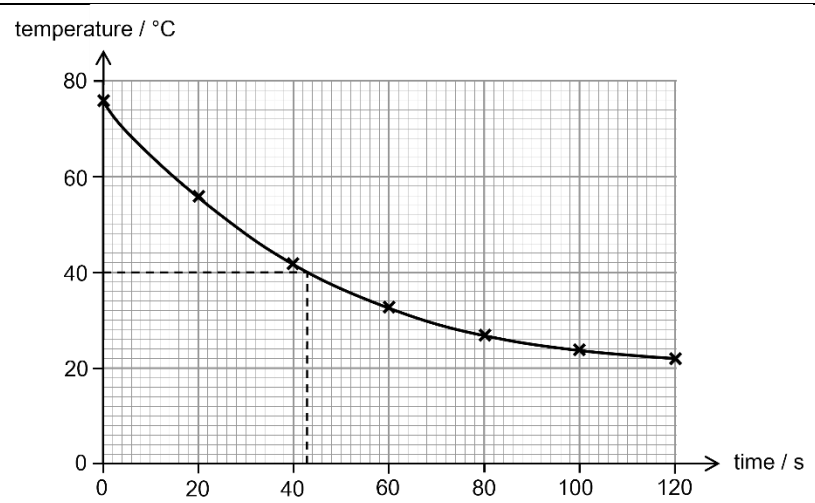
1	**D**	2	**A**	3	**A**	4	**D**	5	**B**
6	**A**	7	**B**	8	**A**	9	**C**	10	**B**
11	**C**	12	**C**	13	**B**	14	**B**	15	**D**
16	**C**	17	**D**	18	**B**	19	**C**	20	**D**

Paper 2

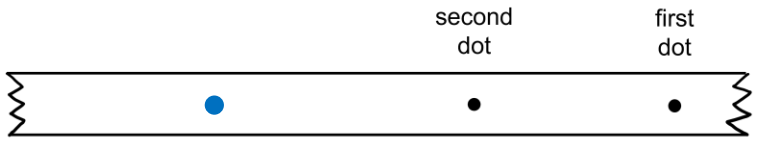
Incorrect s.f. for answer(s) – minus one mark for whole paper

Section A

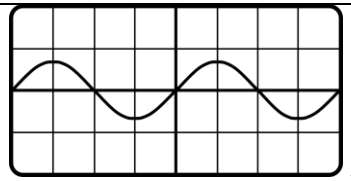
Qn	**Suggested Answer**	**Mark Allocation**	**Remarks**
1(a) **1(b)** **1(c)**	Electronic balance Micrometer screw gauge Stopwatch	1 correct – [1]; 2-3 correct – [2]	(a) the word "balance" must be present (can accept "beam balance); "electronic" must be spelt correctly (b) can accept "Micrometer"
2(a)	Moment = F x perpendicular d = 30 x (50+8) = 1740 N cm Direction of moment is anticlockwise [1]	[1] [1]	The perpendicular distance is from the pivot (the wheel) to the line of action of the 30N force. Direction of moment can never to left/right/up/down; only 2 possibilities – clockwise or anticlockwise.
2(b)	Idea of "Extending the handle increases the perpendicular distance from the upward force to the pivot, thus creates a greater anticlockwise moment" in a logically sound sentence.	[1]	

3(a) (i) (ii)		All data points accurately plotted - [1]; Smooth best-fit curve passing through all points – [1];	Each point must be marked with a cross, with the centre of cross falls accurately of the correct number. Best-fit line must be single and continuous, without obvious kinks and abrupt turns
3(a) (iii)	Between 40 to 46 s	[1] (e.c.f. from the graph)	Do not read to more d.p. than possible from the graph (precision is half the smallest division)
3(b)	Design **A** or **B**. With a logical reason of faster heat loss using either "<u>greater</u> total <u>surface area</u> exposed, increasing rate of radiation emission" Or "more space for more air flow"	[1]	
4(a)	series	[1]	
4(b)	R = V/I, 8 = 4.0 / I, I = 4.0 / 8 = 0.50 A (1,2,3 s.f.)	[1]	
4(c)(i)	Total R = 8 + 1 / (1/4 + 1/4) = 10 Ω (1,2,3 s.f.) Parallel part: 1 / (1/4 + 1/4) OR Series part: 8 + parallel Final answer	 [1] [1]	
4(c)(ii)	The ammeter reading increases.	[1]	Adding another resistor in parallel provides another path for current to flow, increasing the total current.

Section B

Qn	Suggested Answer	Mark Allocation	Remarks
5(a)(i)	F_{res} = ma, 0.32 = 0.40 x a, a = 0.32/0.40 = 0.80 m/s^2 (2 s.f.)	[1]	Answer should be in 2 s.f.
5(a)(ii)	Rate of change of velocity OR Change of velocity per unit time.	[1]	
5(a)(iii)	 Distance from second dot is <u>obviously greater than</u> distance between first and second dot	[1]	The trolley accelerates at 0.80 m/s^2 (a positive number), meaning it is getting faster.
5(b)(i)	a = gradient of s-t graph = (3.5-0) / (5.0-0) = 0.70 m/s^2 (2s.f.) Reading graph and sub in gradient calculation: = (3.5-0) / (5.0-0) Final answer: = 0.70 m/s^2	 [1] [1]	
5(b)(ii)	Mentioning of <u>any resistive force opposing the pulling force</u> e.g. friction between trolley and track, pulling force due to ticker-tape timer and the tape etc. OR Ticker-tape timer is less accurate than the sensor (must be comparison between the two instruments)	[1]	
5(b)(iii)	D = area under graph = ½ x 5 x 3.5 = 8.75 m (2 or 3 s.f.)	[1] (e.c.f. same reading from (b)(i))	
5(b)(iv)	S_{ave} = D / t = 8.75 (b(iii)) / 5.0 = 1.75 m/s (2 or 3 s.f.)	[1] (e.c.f. from (b)(iii))	
6(a)(i)	W = mg = 80 x 10 = 800 N	[1]	

6(a)(ii)	Work = F x d = W x d = 800 (a(i)) x 8.4 = 6720 J (2 or 3 s.f.) OR (Energy at A) + W = (Energy at B); 0 + W = (GPE at B) W = GPE at B = mgh = 80 x 10 x 8.4 = 6720 J (2 or 3 s.f.)	[1] (e.c.f. from (a)(i))	
6(a)(iii)	P = work / t = 6720 (a(ii)) / 16 = 420 W	[1] (e.c.f. from (a)(ii))	
6(b)(i)	Energy cannot be created or destroyed. It can only be changed from one form to another. The total energy of an isolated system remains constant.	[1]	
6(b)(ii)	KE = loss of GPE = mgh = 80 x 10 x (8.4-2.6) = 4640 J Identify loss of GPE: = 80 x 10 x (8.4-2.6) Final answer: = 4640 J	[1] [1]	
6(c)(i)	P = IV, 2200 = I x 240, I = 2200/240 = 9.2 or 9.17 A (2 or 3 s.f.)	[1]	
6(c)(ii)	10 A The fuse rating has to be slightly larger than 9.17A so that it does not melt when the lift operates normally but melts before overheating / prevent overheating.	[1]	
7(a)	A wave that has its direction of **travel** parallel to the direction of particle **vibration**.	[1]	A wave **travels** parallel to the direction of vibration; **NOT** “a wave **is** parallel to …”
7(b)(i)	2d = s x t = 1500 x 0.14 = 210 m d = 210 / 2 = 105 m	[1] [1]	
7(b)(ii)	In space there is vacuum / no matter / no particles present to transfer sound. OR Sound requires matter / particles / medium to transfer.	[1]	

7(c)(i)	 Amplitude lower than A (smaller than 1 division)	[1]	Upper and lower amplitude both smaller than 1 division
7(c)(ii)	Trace C has a lower frequency than A, because sound in C has a lower pitch than sound in A. OR Trace C has a greater period than A OR Trace C has fewer number of completed waves during the same time.	[1]	
7(d)(i)	0.0120 m (precision = 0.0001 m)	[1]	0.012 m is actually incorrect. When doing unit conversion, do not change the precision – the original s.f.
7(d)(ii)	$v = f \lambda$, $1500 = f \times 0.0120$ (d(i)), $f = 1500 / 0.0120 = 125\,000$ Hz	[1] (e.c.f from (d)(i))	