Sec 4 Express / 5 Normal Academic Preliminary Examination 2020 Science (Physics) 5076 Answer Keys and Marking Scheme

PAPER 1 – 20 M									
1	2	3	4	5	6	7	8	9	10
В	Α	D	D	С	Α	С	С	D	С
11	12	13	14	15	16	17	18	19	20
С	D	Α	D	С	Α	D	С	В	С

PAPER 2 SECTION A - 45 M

1a		B2
	diameter of Earth 10 Mm	
	diameter of an atom 0.1 nm	
	diameter of human hair 0.1 mm	
	distance between Bukit Panjang and Bugis by car	
	B2 – all correct, B1 - 2 to 3 correct, B0 – 0 to 1 correct	
1b	Taking a vernier callipers / micrometer screw gauge , measure the thickness of 200 pieces of papers . Then divide by 100 to get the average thickness of 1 piece of paper.	B2
	B2 – all 3 points, B1 – 2 points, B0 – no marks if just mention instrument without description of steps	
2a	speed / m / s 40^{-1}_{-1} $40^{$	B2
	B1 – smoothness of the graph	

2b	Constant acceleration for the first 6 seconds. Constant velocity from 6 to 12 seconds. Decreasing deceleration from 12 to 22 seconds.	B2
	B2 – all 3 points, B1 – 2 points, B0 – 0 to 1 point	
	(ecf from 2a)	
2ci	$a = \frac{v - u}{t}$	
	$=\frac{30-0}{6}$	M1
	$=5m/s^2$	A1
	(ecf from 2b)	
2cii	F = ma	
	=1500(5)	
	=7500N	B1
	(ecf from 2c)	
3a	For a body in equilibrium, the sum of anticlockwise moments must be equal to the sum of clockwise moments about the same pivot.	B1
	*note: must include "same pivot" to award B1	
3b	ACM = CM	
	$F \times 0.3 = 450 \times 1.3$	M1
	F = 1950N	A1
3c	Move the counterweight to increase the perpendicular distance to the	B1
	pivot, So that for the same moment , F can be reduced.	B1
	Or	
	Reduce the weight of the pole, So that the total clockwise moment decreases , learning to a smaller F.	
	Accept other reasonable answers.	
4a	Energy cannot be created or destroyed. However it can be converted from one form to another. Total energy must remain the same.	B2
	B2 – all 3 points, B1 – 2 points, B0 – 0 to 1 point	

4bi	GPE = mgh	
	= 2500(10)(40)	M1
	1. $= 100000 J$	A1
4bi	$KF - \frac{1}{2}mv^2$	
	$\frac{1}{2}m^{2}$	
	$=\frac{1}{2}(2500)(12^2)$	M1
	2 = 180000J	A1
4bii	The kinetic energy at C is less than the gravitational potential energy at	B1
	A	B1
	because some of the gravitational potential energy is converted to heat	
	(thermal energy) and/or sound energy due to friction. (or loses energy to	
	surrounding as near and/or sound energy)	
5a	Air/plastic/foam is a bad conductor of heat, so heat loss from the water is	B1
	reduced.	
	Conduction cannot happen through vacuum.	B1
5b	The plastic can prevents convection from setting up above the water	B1
50	The plastic cap prevents convection from setting up above the water.	
	Convection cannot happen in a vacuum.	B1
5c	The silvered surfaces reflect radiant heat back into the water, reducing heat	B1
	loss.	
	Or	
	The silvered surfaces are poor emitter of radiation , reducing heat loss.	
6ai	1. 1.25 s	B1
6ai	2. 0.8 Hz	B1
	(ecf from 6ai 1)	
6aii	The ball will move downward to the trough and move back up again.	B1
6bi	Ultraviolet radiation	B1
6bii	Might get sunburnt.	B1
	Might have skin cancer.	
	Accept other reasonable answers.	
7a	The car door is negatively-charged	B1
	as the positively-charged droplets are attracted to the door.	B1
		1

7bi	An electric field is a region where an electric charge will experience a force.	B1
7bii	B0 if lines touch or cross each other.	B1
8a	Current is the rate of flow of charges.	B1
8b	 0 A because current flows through S1 as it is a lower resistance wire. OR 0 A because when S1 is closed, short circuit occurred and no current flows through the resistor. 	B1
8c	Total effective resistance will increase.	B1
	Therefore with the same emf through the circuit, the current will decrease . Thus \mathbf{A}_2 will be lower.	B1
8d	$R = \frac{V}{I}$ $= \frac{12}{0.5}$ $= 24\Omega$ $\frac{1}{R_{parallel}} = \frac{1}{4} + \frac{1}{6}$ $R_{parallel} = 2.40\Omega$ $R = 24 - 8 - 2.40$ $= 13.6\Omega$	M1 M1 A1

PAPER 2 SECTION B - 20 M

9ai		B1
9aii	It is the angle of incidence where the angle of refraction in the optically less dense medium is 90°.	B1
	OR	
	It is the angle between the normal and the incident ray in which the refracted ray travels along the surface of the block.	
9aiii		B1
	Tay box	
Qiv		
910	$n = \frac{1}{\sin c}$	
	1	
	$=\frac{1}{\sin 47}$	
	=1.37	B1
9bi		B1
	Any light ray that shows the location of the F accurately.	
9bii	Focal length is the distance between the optical centre and the focal point.	B1
9biii	Projector	B1

9c		
	в	
	(i) Show that image is equidistant away from the mirror as the object	B1
	(ii) P2 if two correct light rave with arrows and dotted lines behind mirror	B2
	B1 if – two correct light rays but no arrows	
	 two correct light rays with arrows but <u>not</u> dotted lines behind mirror 	
	 – two correct light rays with dotted lines behind mirror but no arrows – one correct light ray with arrow and dotted lines behind mirror 	
10ai	Longitudinal wave is where the vibration of the particles is parallel to the direction of wave motion	B1
10aii	When the source vibrates , the surrounding air particles are displaced. This	B2
	microphones in the form of longitudinal waves.	
	$B_2 - all 3 points, B_1 - 2 points, B_0 - 0 to 1 point$	
10aiii	d	
	$S = \frac{1}{t}$	
	$=\frac{5}{5}$	M1
	15×10^{-3}	Δ1
	= 333m / s	
10bi	to is longer than t because	B1
	the distance travelled without cracks is longer .	B1
10bii	$y = f \lambda$	
100	$V = J \lambda$	
	$3500 = 20 \times 10^{10} \times \lambda$	M1 ⊿1
	$\lambda = 0.1 / 5m$	
10biii	Sound is less harmful.	B1
	Sound requires less energy.	
	The imaging result using sound is instantaneous.	
	X-ray is dangerous.	
	X-ray requires special equipment / operators.	
	A ray ban only image one at a time.	

	Accept other reasonable answers.	
11a	Record the ammeter reading and voltmeter reading. Repeat the experiment by changing the resistance on the rheostat. Plot a graph of V against I. The gradient is the resistance of the light bulb. B3 – 4 points, B2 – 3 points, B1 – 2 points, B0 – 0 to 1 point	B3
11b	$Y = 120 \Omega$ Z = 90 Ω	B1 B1
11ci	Fuse. It melts and break the circuit when the current is too high .	B1
11cii	 Wire A. If the live wire is exposed to the metal casing, the earth wire directs the current away from the user, causing the fuse to break and thus preventing electric shock. B2 – correct wire and 3 points, B1 – correct wire and 2 points, B0 – correct wire but 1 point / B0 if wrong wire is identified 	B2
11ciii	The switch should be connected to the live wire because the electric cooker will not become live / exposed to high voltage , thus preventing user from electric shock . B2 – 3 points, B1 – 2 points, B0 – 0 to 1 point	B2