Mark Scheme (RESULTS)

October 2020

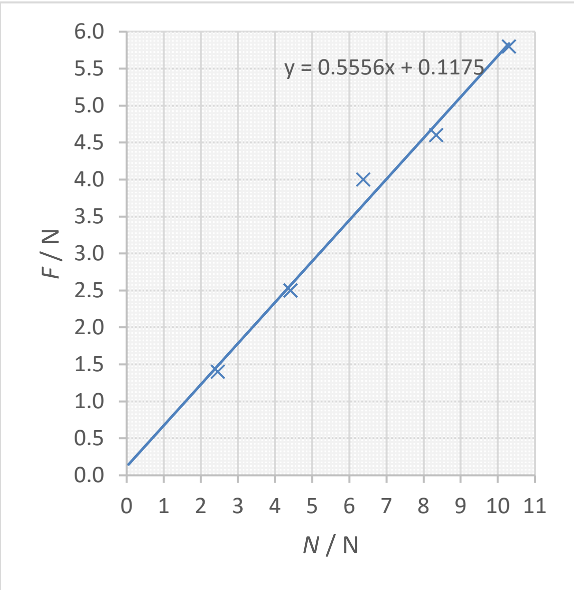
Pearson Edexcel International Advanced Subsidiary/Advanced Level
In Physic (WPH13)
Paper 1: Practical Skills in Physics I

Question Number	Answer		Mark
1(a)(i)	• Heating apparatus e.g. hot plate **Or** Cooling apparatus e.g. ice/water bath	(1)	**1**
1(a)(ii)	• Timing apparatus e.g. stop clock, stopwatch	(1)	**1**
1(b)	• Digital thermometer has higher resolution e.g. measures to 0.1˚C **Or** digital thermometer has no parallax error • Digital thermometer has a lower (percentage) uncertainty Accept attempts to calculate percentage uncertainty for both thermometers for MP1	(1) (1)	**2**
1(c)(i)	• Suitable control variable e.g. volume of oil, mass of oil Do not accept temperature of oil/room	(1)	**1**
1(c)(ii)	• Suitable method of control for the control variable identified e.g. check the volume in the measuring cylinder after each pour check the mass using a balance	(1)	**1**
1(d)(i)	• Rate of flow = volume/time	(1)	**1**
1(d)(ii)	**Max 2 from** • Starting timer after oil has been poured e.g. marking a start position, starting at 10 cm^3 • Stopping timer before the funnel is empty e.g. stopping after a fixed volume or at a marker • Record the volume after a fixed time period • Repeat for the same temperature and calculate the mean time • Use of light gates and (electronic) timer to avoid (human) reaction time	(1) (1) (1) (1) (1)	**2**
	Total for question 1		**9**

Question Number	Answer	Mark
2(a)	• Curved line of best fit (1)	**1**
2(b)(i)	• Minimum p.d. read from their line on the graph (1)	**1**
2(b)(ii)	• Use of $W = VQ$ with $Q = 1.6 \times 10^{-19}$ C and value of V from (b)(i) (1) • Value of W in the range of 2.5×10^{-19} to 3.0×10^{-19} (J) (1) <u>Example of calculation</u> $W = VQ$ $W = 1.8 \text{ V} \times 1.6 \times 10^{-19} \text{ C}$ $W = 2.9 \times 10^{-19} \text{ J}$	**2**
2(c)	• Use of $c = f\lambda$ (with $\lambda = 625$ nm) (1) • Use of $E = hf$ (1) • $h = 6.5 \times 10^{-34}$ J s (1) (Use of $E = hc/\lambda$ scores MP1 and MP2) <u>Example of calculation</u> $c = f\lambda$ $3.0 \times 10^{8} \text{ m s}^{-1} = f \times 625 \times 10^{-9} \text{ m}$ $f = 4.8 \times 10^{14}$ Hz $E = hf$ $3.1 \times 10^{-19} \text{ J} = h \times 4.8 \times 10^{14} \text{ Hz}$ $h = 6.5 \times 10^{-34}$ J s	**3**
2(d)	• There would be an uncertainty in wavelength/frequency **Or** there would be a range of wavelengths/frequencies **Or** the LED emits different wavelengths/frequencies (1) • If wavelength was longer, the calculated Planck constant would be larger **Or** if the frequency was lower, the calculated Planck constant would be larger (1) • There would be an uncertainty in the calculated Planck constant **Or** there would be a range of possible values of the Planck constant (1) MP2 - Accept converse arguments for shorter wavelength or higher frequency	**3**
2(e)	• Take measurements for additional p.d.s between 1.5 and 2.0V **Or** Take measurements for smaller increments in p.d. (1) • This would allow for a more accurate line of best fit to be drawn **Or** to more accurately identify the p.d. where the line touches the x-axis (1) Accept use of a datalogger for MP1	**2**
	Total for question 2	**12**

Question Number	Answer	Mark
3(a)	• Voltmeter connected in parallel to solar cell only (1) • Ammeter connected in series with the solar cell **and** resistor (1) MP1 - Accept voltmeter connected in parallel to the resistor only, if no other resistance components (e.g. variable resistor, bulb, etc) are added Additional cells added – Not MP2.	**2**
3(b)	**Max 2 from** • Same distance between lamp and solar cell (1) • Keep angle of solar cell to light the same (1) • Block background light **Or** control background light level **Or** avoid casting shadows on the solar cell (1)	**2**
3(c)	• Suitable method to vary solar cell temperature e.g. immersion in a water bath, clamped a fixed distance from a hair dryer (must include a method, rather than just naming a heat source) (1)	**1**
3(d)	• Use of $P = VI$ (1) • $P = 0.12$ W (1) <u>Example of calculation</u> $P = VI$ $P = 2.74\text{V} \times 45 \times 10^{-3}\text{A}$ $P = 0.12$ W	**2**
3(e)	• Use of $I = P / A$ (1) • Use of efficiency = useful power output / total power input (1) • Efficiency = 0.17 (17%) (1) Allow ecf from 3(d) for useful power output For MP1 & 2 accept a calculation of power output per m^2 and efficiency calculated using input of 200 W m^{-2} For MP3 there should be no unit given or correct conversion to % <u>Example of calculation</u> $I = P / A$ $P = 200 \text{ W m}^{-2} \times (60 \times 10^{-3})^2$ $P = 0.72$ W Efficiency = useful power output / total power input Efficiency = 0.12 W / 0.72 W = 0.17	**3**
3(f)(i)	**Max 2 from** • Too few readings (1) • Too small a range of temperatures (1) • Inconsistent intervals in temperature readings (1) • Inconsistent d.p. in current values (1)	**2**

3(f)(ii)	• Calculate output power for each temperature (1) • Plot graph of power (on the y-axis) against temperature (on the *x*-axis) (1) • Calculate the gradient (which is the power change per 1˚C) (1) **OR** • Calculate output power for each temperature (1) • Plot graph of temperature (on the y-axis) against power (on the *x*-axis) (1) • Calculate 1/gradient (which is the power change per 1˚C) (1)	**3**
	Total for question 3	**15**

Question Number	Answer		Mark
4(a)	• Increase the mass of the slotted masses until rubber starts to slide • Calculate friction/tension/weight using *mg* **Or** measure weight of slotted masses (with a newton meter)	(1) (1)	**2**
4(b)(i)	• Add 250 g to mass *m* **Or** add 0.25 kg to mass *m* **Or** add 2.45 N to the weight of m • Use $W = mg$	(1) (1)	**2**
4(b)(ii)	• Labels axes with quantities and units • Sensible scales • Plotting • Line of best fit  **N / N** | **F / N** 2.45 | 1.4 4.41 | 2.5 6.38 | 4.0 8.34 | 4.6 10.3 | 5.8	(1) (1) (2) (1)	**5**
4(c)	• Calculates gradient using large triangle • Value of μ in the range of 0.54 to 0.59 • Value given to 2 or 3 s.f. with no unit <u>Example of calculation</u> Gradient = (5.6 N – 0.6 N) ÷ (10.0 N – 1.0 N) = 0.556	(1) (1) (1)	**3**
4(d)	• To test tyres would provide enough friction/braking force **Or** to test tyres provide enough grip **Or** to test the rubber on wet/icy/cold/loose surface materials • So that the tyres can stop the car in a safe distance/time **Or** to prevent cars from skidding/sliding	 (1) (1)	**2**
	Total for question 4		**14**