# Mark scheme

## Current, voltage and resistance

Physics 0625 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

**81**

### MARKS FOR EACH QUESTION

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 9 | 10 | 5 | 7 | 8 | 8 | 9 | 7 | 11 | **81** |

## Question 1 [7]

| | | |
|---|---|---|
| **1**(a)(i) | voltmeter | **B1** |
| **1**(a)(ii) | volts | **B1** |
| **1**(b)(i) | (*R*=) $V \div I$ or $V = I \times R$ or in any form | **C1** |
| | 6.4 ÷ 0.2 | **C1** |
| | 32 (Ω) | **A1** |
| **1**(b)(ii) | increase the length (of the wire using the same thickness) | **B1** |
| | smaller diameter (of wire using the same length) | **B1** |

## Question 2 [9]

| | | |
|---|---|---|
| **2**(a) | top to heater | **B1** |
| | middle to thermistor | **B1** |
| | bottom to galvanometer | **B1** |
| **2**(b)(i) | voltmeter symbol | **B1** |
| | in parallel with resistor / supply | **B1** |

| | | |
|---|---|---|
| **2**(b)(ii) | $V = I \times R$ in any form | **C1** |
| | 11.5 ÷ 0.25 | **C1** |
| | 46 | **A1** |
| | ohms / Ω | **B1** |

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## Question 3 [10]

| | | |
|---|---|---|
| 3(a)(i) | Thermistor correctly identified | B1 |
| 3(a)(ii) | correct symbol for voltmeter | B1 |
| | Voltmeter in parallel with thermistor | B1 |
| 3(b)(i) | V= IR | C1 |
| | (R) = 6.0 ÷ 0.010 | C1 |
| | 600 (ohms or Ω) | A1 |
| 3(b)(ii) | Resistance is decreasing | B1 |
| | So current will increase | B1 |
| 3(b)(iii) | Current greater than 0.04 (A) | B1 |
| 3(c) | 700 (ohms or Ω) | B1 |

## Question 4 [5]

**4** **(a)** **(i)** (I =) V/R **or** 230/46 C1
5.0 A *Unit penalty applies A1

**(ii)** (P =) IV **or** $V^2$/R **or** $I^2$R **or** 230 × 5 **or** $230^2$/46 **or** $5^2$ × 46
ecf from **8(a)(i)** C1
1100/1150/1200 W *Unit penalty applies ecf from **8(a)(i)** A1

**(b)** same as **8(a)(i)** (**c.a.o.**) *Unit penalty applies B1 **[5]**

*Apply unit penalty once only

## Question 5 [7]

**5** **(a)** **(i)** rectifier / diode B1

**(ii)** frequency (of A.C. supply) B1

**(b)** **(i)** (*P* =) *IV* **OR** 0.5 × 5.3 **OR** 500 × 5.3 C1
2.6 W **OR** 2600 mW A1

**(ii)** (*E* =) *Pt* **OR** *IVt* **OR** 2.65 × 1.5 × 3600 **OR** 0.5 × 5.3 × 1.5 × 3600 C1
14000 J A1

**(c)** energy only underlined B1

**[Total: 7]**

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## Question 6 [8]

| | | |
|---|---|---|
| **6**(a) | energy supplied | **M1** |
| | to drive a unit charge / 1 C round a complete circuit | **A1** |
| **6**(b)(i) | ($R$ =) 2.3 Ω OR 2.2 Ω | **A3** |
| | $R = V/I$ in any form | **C1** |
| | current in R = 4 (A) OR p.d. across R = 9 (V) | **C1** |
| **6**(b)(ii) | 1.1 Ω | **A3** |
| | resistance proportional to length (so twice length twice resistance) | **C1** |
| | resistance inversely proportional to area (so twice diameter decreases resistance by factor of 4) | **C1** |

## Question 7 [8]

| | | |
|---|---|---|
| **7**(a) | ($I$ =) 9.8 A | **A3** |
| | $P = I^2R$ **OR** $I^2 = \frac{P}{R}$ **OR** $I^2 = \frac{2500}{26}$ | **C1** |
| | $I^2$ = 2500 / 26 **OR** ($I$ =) √($P$ / $R$) **OR** $\sqrt{\frac{2500}{26}}$ | **C1** |
| **7**(b) | ($R$ =) 53 Ω | **A3** |
| | $R \propto l$ **OR** 1.8 / 1.2 **OR** 1.5 seen as multiplier | **C1** |
| | R ∝ 1 / $A$ **OR** 7.9 (× $10^{-7}$) / 5.8 (× $10^{-7}$) **OR** 1.36(2) seen as multiplier | **C1** |
| **7**(c) | (cost =) $36 | **A2** |
| | $E = Pt$ **AND** (cost =) $E$ × 0.3(0) **OR** (cost =) 25 × $10^N$ × 2 × 24 × 0.3(0)<br>**OR** 3.6 × $10^N$ dollars | **C1** |

## Question 8 [9]

| | | |
|---|---|---|
| **8**(a)(i) | 900 C | **A2** |
| | $I = Q / t$ **OR** ($Q$ =) $It$ **OR** 1.5 × 600 | C1 |
| **8**(a)(ii) | 2.0 Ω | **A3** |
| | $R = V / I$ **OR** ($R_{tot}$ =) $V / I$ **OR** 9.(0) / 1.5 **or** 6.(0) | C1 |
| | ($R_{cyl}$ =) total resistance – P **OR** ($R_{cyl}$ =) 6.0 – 4.0 | C1 |
| **8**(b) | 1200 s | **A4** |
| | $R$ is directly proportional to $l$ **OR** (new cylinder) twice as long means twice R | C1 |
| | $R$ is inversely proportional to $A$ **OR** (new cylinder) half cross-sectional area means twice R | C1 |
| | (resistance of cylinder =) 4 × **(a)(ii)** (Ω) | C1 |

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## Question 9 [7]

| | | | |
|---|---|---|---|
| 9 | **MP1** | **circuit diagram:**<br>correct voltmeter circuit symbol shown in parallel with all or part of wire | 1 |
| | **MP2** | **apparatus:**<br>metre ruler | 1 |
| | **MP3** | **method:**<br>measure / record length;<br>measure p.d. and current;<br>specific reference to repeating with different length | 1 |
| | **MP4** | **key / control variable:**<br>constant diameter / radius / gauge of wire<br>material of wire / same wire / same type of wire | 1 |
| | **MP5** | **table:**<br>columns, with units, for length, p.d., current, resistance | 1 |
| | **MP6** | **analysis:**<br>compare readings in the table to see <u>if</u> change in length produces change in resistance<br>plot resistance-length or length-resistance graph | 1 |
| | **MP7** | **additional point** (one from)**:**<br>at least 5 sets of data taken;<br>repeat for each length <u>and</u> take average;<br>2nd control variable: diameter / material / temperature of wire;<br>use of protective resistor | 1 |

## Question 10 [11]

| | | |
|---|---|---|
| **10**(a) | ammeter in series connection <u>or</u> voltmeter in parallel connection | 1 |
| | second meter shown connected correctly <u>and</u> circuit complete | 1 |
| **10**(b)(i) | $V = 2.8$ | 1 |
| | $I = 0.32$ | 1 |
| **10**(b)(ii) | $R = 8.75$ / ecf, 5.78, 5.00, 3.19 | 1 |
| | $R$ consistent to 2 or 3 significant figures | 1 |
| **10**(b)(iii) | V, A, Ω all correct | 1 |
| **10**(c)(i) | $P = 1.51$ / ecf <u>and</u> $Q = 1.57$ / ecf | 1 |
| **10**(c)(ii) | statement matching results and values used | 1 |
| | justification matching statement<br>e.g. within limits of experimental accuracy / owtte | 1 |
| **10**(d) | valid inherent source of inaccuracy e.g.: crocodile clip connection not even /<br>difficult to connect at exactly the correct length / resistance wires not uniform | 1 |

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