# Electricity- Potential Dividers Past Paper Answers AQA Physics A Level

## 1.

| | | | |
|---|---|---|---|
| .1 | energy of photon ✓<br>is greater than the work function✓<br>so electrons are emitted✓ | If correct reference to threshold frequency and no mention of work function then only score one of first two marks and can be awarded third mark | 1<br>1<br>1 |
| .2 | increased intensity means more photons incident per second✓<br>current greater OR more electrons emitted per second✓ | only need to see per second once<br>rate of photons incident OK (or rate of electrons emitted) | <br>1<br>1 |
| .3 | (*use of* $hf = \phi + E_k$)<br>$\phi = 2.1 \times 1.6 \times 10^{-19} = 3.36 \times 10^{-19}$ ✓(J)<br>$E_k = 6.63 \times 10^{-34} \times 7.23 \times 10^{14} - 3.36 \times 10^{-19}$✓<br>$E_k = 1.4(3) \times 10^{-19}$ ✓(J) | If incorrect or no conversion to J then CE for next two marks | 1<br>1<br>1 |
| .4 | (*use of* $eV = E_k$)<br>$V_s = 1.43 \times 10^{-19} / 1.6 \times 10^{-19} = 0.89$ (V)✓ | CE from 05.3<br>RANGE 0.70 – 0.90 | <br>1 |
| .5 | stopping potential would be greater✓<br>because the energy of the photons (of the electromagnetic radiation) would be greater✓<br>(hence) maximum kinetic energy of (photo)electrons would be greater✓ | | 1<br>1<br>1 |

## 2.

| | | | |
|---|---|---|---|
| (a) | | (use of $1/R_{total} = 1/R_1 + 1/R_2$)<br>$1/R_{total} = 1/400 + 1/400 = 2/400$<br>$R_{total} = 200\,\Omega$ ✓ (working does not need to be shown)<br>hence total resistance = 25 + 200 = 225 Ω ✓ | **2** |
| (b) | (i) | (use of $P = V^2/R$)<br>$1 = V^2/400$ ✓<br>$V^2 = 400$ (working does not need to be shown)<br>$V = 20$ V ✓ | **6** |
| | (ii) | (use of $I = V/R$)<br>$I = 20/400 = 0.05$ A ✓ (working does not need to be shown)<br>hence current = 2 × 0.05 = 0.10 A ✓ | |
| | (iii) | (use of $V = IR$)<br>pd across 25 Ω resistor = 25 × 0.10 = 2.5 V ✓ (working does not need to be shown)<br>hence maximum applied pd = 20 + 2.5 = 22.5 V ✓ | |
| | | **Total** | **8** |

**3.**

| | | | |
|---|---|---|---|
| (a) | (i) | 6.0 (Ω) ✓ | **1** |
| (a) | (ii) | 4.5 (V) ✓ | **1** |
| (a) | (iii) | (use of $I = V/R$)<br>$I = 4.5/6.0 = 0.75$ (A) ✓<br>current through cell A = 0.75/2 = 0.375 (A) ✓ | **2** |
| (a) | (iv) | charge = 0.375 × 300 = 112 ✓ C ✓ | **2** |
| (b) | | cells C and D will go flat first or A and B last longer ✓<br>current/charge passing through cells C and D (per second) is double/more than that passing through A or B ✓<br>energy given to charge passing through cells **per second** is double or more than in cells C and D ✓ or in terms of power | **3** |
| | | **Total** | **9** |

**4.**

| | | | |
|---|---|---|---|
| (a) | | current = 0.40 A ✓ | **1** |
| (b) | (i) | resistance = 12/0.2 = 60 Ω ✓ | **1** |
| (b) | (ii) | power = 12 × 0.2 = 2.4 W ✓ | **1** |
| (c) | | resistance of filament increases **or** more collisions/scattering ✓<br>as temperature of filament increase **or** filament gets hot/heats (until reaches thermal equilibrium) ✓ | **2** |
| (d) | (i) | voltage of supply now shared by lamps **or** resistance increased ✓<br>hence current reduced ✓ | **2** |
| (d) | (ii) | current through the **lamps** unchanged/stays the same ✓<br>as both connected directly to the supply **or** correct resistance argument ✓ | **2** |
| (e) | | resistance of lamps will be lower when first switched on ✓<br>hence initial current will be larger ✓<br>sudden rapid change in temperature ✓ | **max 2** |
| | | **Total** | **11** |

**5.**

<table>
<tr><td>a</td><td>(i)</td><td>1/R<sub>total</sub> = 1/(40) ✓+1/(10+5) ✓= 0.09167<br>R<sub>total</sub> = 10.9 kΩ✓</td><td>3</td><td></td></tr>
<tr><td>a</td><td>(ii)</td><td>I = 12/10.9k = 1.1 mA✓</td><td>1</td><td></td></tr>
<tr><td>b</td><td></td><td><table><tr><td>position</td><td>pd/V</td></tr><tr><td>AC</td><td>6.0✓</td></tr><tr><td>DF</td><td>4.0✓</td></tr><tr><td>CD</td><td>2.0✓</td></tr></table></td><td>3</td><td>C.E. for CD</td></tr>
<tr><td>c</td><td>(i)</td><td>AC: no change✓<br>constant pd across resistors/parallel branches(AE)✓</td><td>2</td><td>no CE from first mark</td></tr>
<tr><td>c</td><td>(ii)</td><td>DF: decreases✓<br>as greater proportion of voltage across fixed/10 kΩ resistor✓</td><td>2</td><td>no CE from first mark</td></tr>
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