Mark scheme for Extension Worksheet – Option F, Worksheet 4, HL only

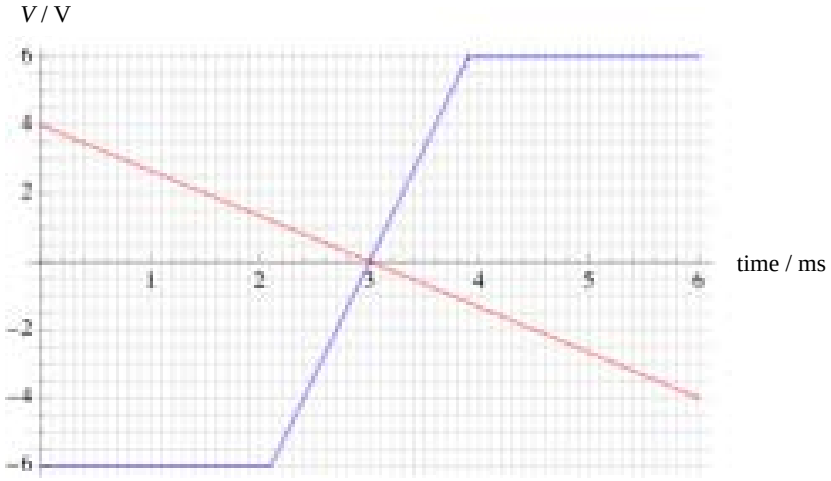
1 **a** $G = -\frac{R_F}{R} = -\frac{80}{16} = -5.0$ [1]

b $V_{OUT} = GV_{IN} = (-5.0) \times (-0.60)$; $V_{OUT} = +3.0$ V [2]

c $6.0 = GV_{IN} \Rightarrow V_{IN} = \frac{6.0}{-5.0} = -1.2$ V; the output will then be +6.0 V for input −2.0 V [2]

d The magnitude of the potential difference across the feedback resistor is $|GV_{IN} - 0| = |-5.0 \times 1.2 - 0| = 6.0$ V; and so the current is $I = \frac{6.0}{80 \times 10^3} = 75$ mA [2]

e See graph in blue: [1] for each correct leg of the graph.



[3]

2 **a** $G = 1 + \frac{R_F}{R} = 1 + \frac{120}{20} = 7.0$ [1]

b $V_{out} = GV_{in} = 7.0 \times (-0.50)$; $V_{out} = -3.5$ V [2]

c $6.0 = GV_{in} \Rightarrow V_{in} = \frac{6.0}{7.0} = 0.857$ V; the output will then be +6.0 V for input 3.0 V [2]

3 Dispersion, noise and attenuation will, in general, distort a digital signal during transmission; the Schmitt trigger compares to the voltage of the signal to two reference values; one when the voltage is increasing and one when it is decreasing. [3]