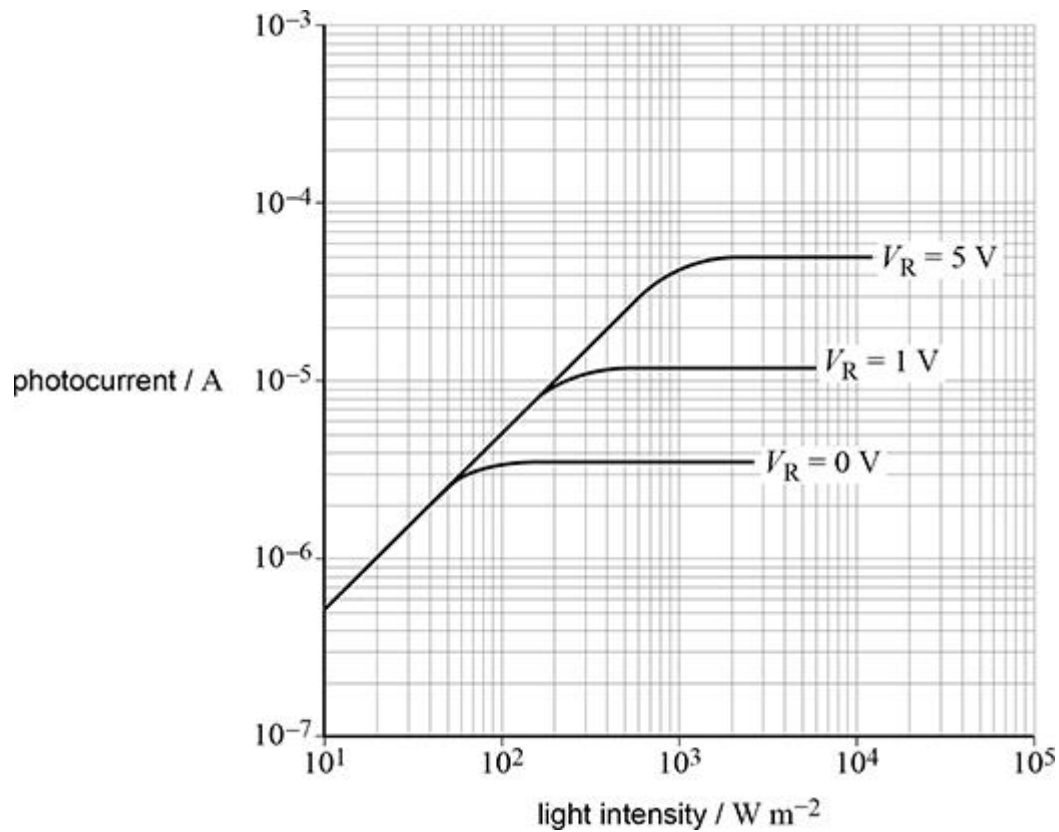## Q1.

(a) **Figure 1** shows the response of a photodiode for different values of reverse-bias voltage V_R.

Figure 1

The photodiode is used as the input for a light-intensity meter.

The light intensity changes from 100 W m^{-2} to 400 W m^{-2}.

Explain which value of V_R in **Figure 1** should be used for this application. Go on to deduce the change in photocurrent for this change in light intensity.

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_____

change in photocurrent = _____ A

(2)

(b)   Describe how a photodiode is used in a particle detector to detect
sub-atomic particles.

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(2)

(c)   The particle detector produces an analogue signal that is the input voltage
V_{in} to an amplifier circuit.
V_{in} is amplified by a factor of +10

Draw, on **Figure 2**, a circuit that uses a single operational amplifier to
produce an amplification of +10

Use resistors with resistance values in the range 10 $k\Omega$ to 1 $M\Omega$ in the
circuit.

On your diagram you should label:
•   the value of the resistors
•   the output of the circuit as V_{out}.

Do **not** show the power supplies for the operational amplifier.

Figure 2

V_{in} o————

0 V o————————————————————————————————o
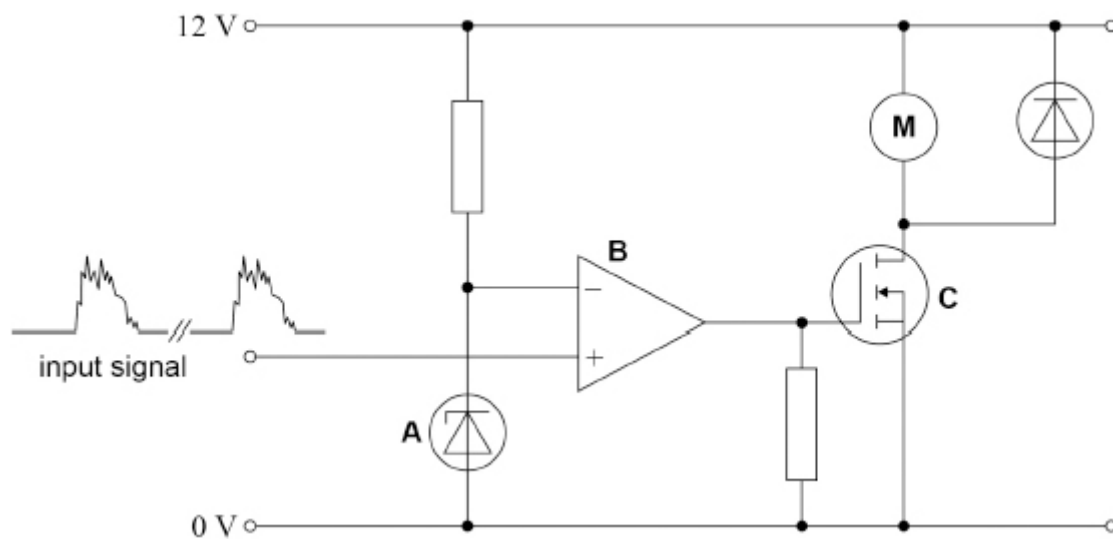
(3)
(Total 7 marks)

Q2.

The figure below shows a circuit that has an input signal which is a noisy square wave.
The circuit is used to remove the noise and switch a motor **M** on and off.

Explain the functions of components **A**, **B** and **C**.

For each of these components you should:

*   explain its role in the circuit
*   identify the characteristic properties that make the component suitable for this role.

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(Total 6 marks)