

- 7 (a) A photon has an energy of  $3.11 \times 10^{-19}$  J.

Calculate the momentum of the photon.

$$\text{momentum} = \dots \text{Ns} \quad [2]$$

- (b) A laser beam has a power of 350 mW. The light from the laser has a wavelength of 640 nm.

- (i) Determine the number of photons emitted by the laser in a time of 1.0 s.

$$\text{number} = \dots \quad [2]$$

- (ii) The laser beam is incident normally on a surface that absorbs all of the photons.

Show that the force  $F$  exerted on the surface by the laser beam is given by

$$F = \frac{P}{c}$$

where  $P$  is the power of the laser beam and  $c$  is the speed of light.

[2]

- (c) Light of a single wavelength is incident on the surface of different metals. The work function energy of the metals is given in Table 7.1.

**Table 7.1**

metal	work function energy/eV
tungsten	4.49
magnesium	3.68
potassium	2.26

- (i) Explain the term threshold wavelength.

.....  
.....  
.....

[1]

- (ii) For the metals in Table 7.1, calculate the value of the largest threshold wavelength.

threshold wavelength = ..... m [2]

[Total: 21]