Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

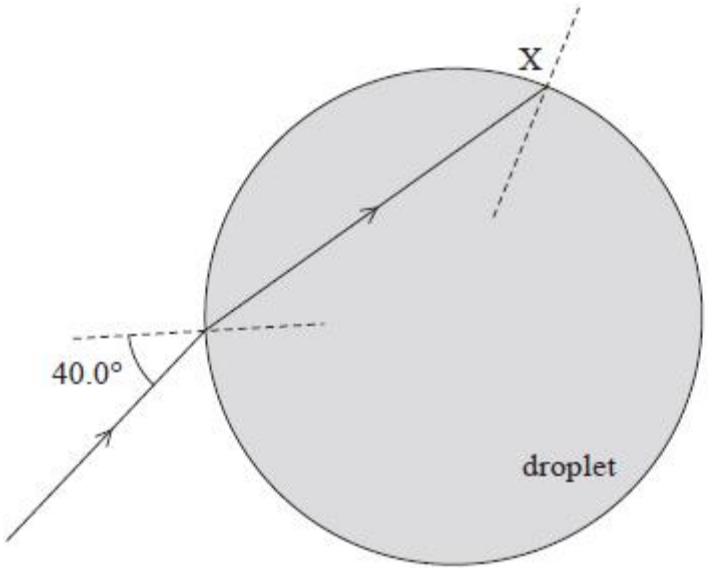
Q1.

Lighthouses are located along coastlines to aid navigation. A lighthouse emits an intense beam of light. In clear weather the beam is visible for long distances, but in foggy weather the visibility of the beam is limited.

The beam is refracted by water droplets in the air.

A light ray in the beam is incident on a spherical water droplet with an angle of incidence of 40.0°. The ray passes through the droplet and meets the water-air boundary at X as shown.

Diagram **NOT** to scale



Deduce whether the ray leaves the water droplet at point X.

speed of light in water = 2.25×10^8 m s^{-1}

(4)

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(Total for question = 4 marks)

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Q2.

The power of the lens in the human eye changes as the lens changes shape. This enables a person to see objects at different distances clearly. To change the shape, muscles in the eye put the lens under stress.

A teacher was modelling the human eye. He placed an object 60 cm from a converging lens system. A real image of the object was observed with a magnification of 0.5

The converging lenses that were available to the teacher had powers of 2D, 3D and 4D.

Deduce which lens, or combination of lenses, the teacher used.

(4)

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(Total for question = 4 marks)

Q3.

In a demonstration of the photoelectric effect, electromagnetic radiation of frequency f was incident on the surface of a metal. The maximum kinetic energy E_{max} of the emitted photoelectrons was determined for increasing values of f.

No photoelectrons are emitted when the frequency of the radiation is below a certain value.

Explain why.

(3)

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(Total for question = 3 marks)

Q4.

In a demonstration of the photoelectric effect, electromagnetic radiation of frequency f was incident on the surface of a metal. The maximum kinetic energy E_{max} of the emitted photoelectrons was determined for

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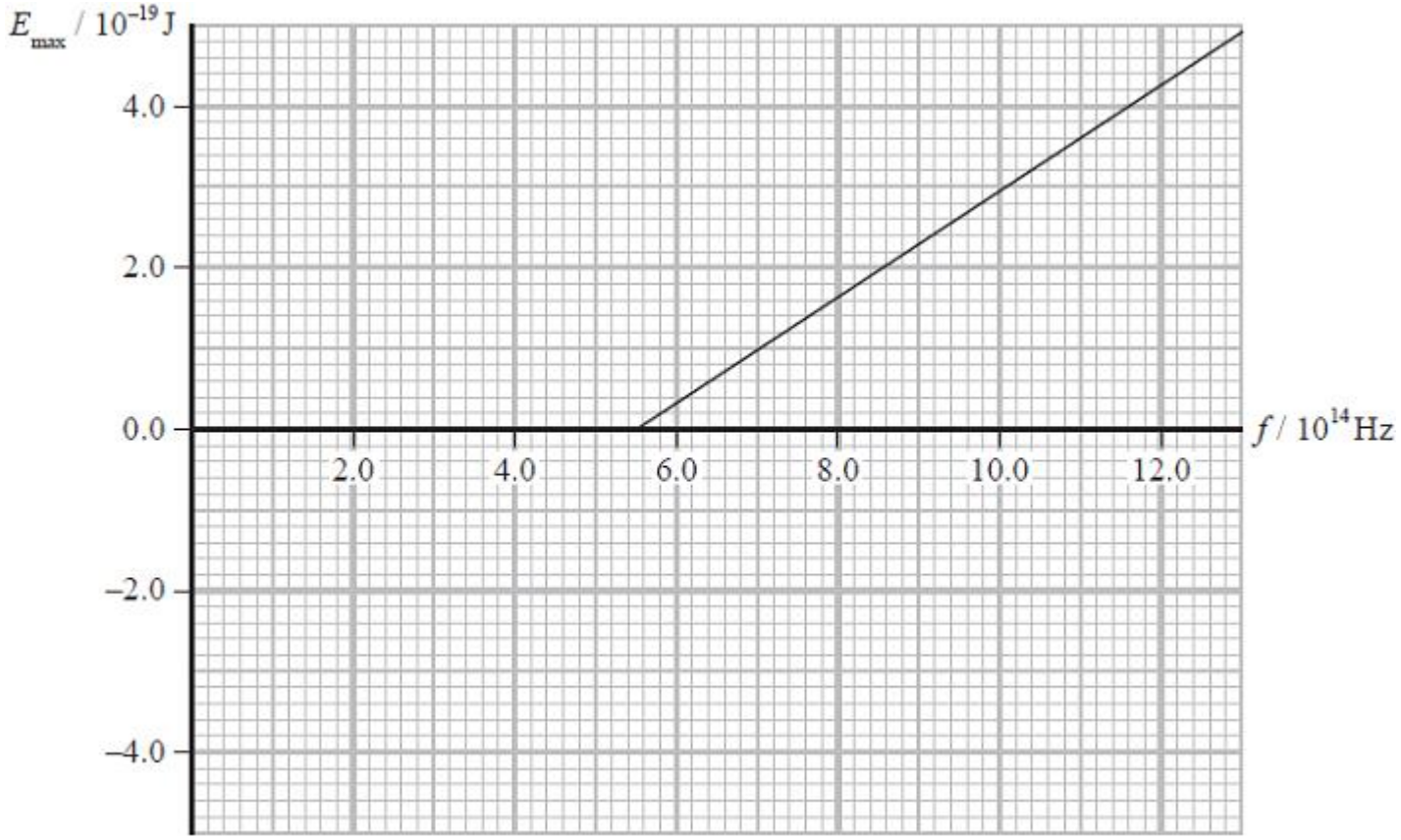
increasing values of *f*.

The graph shows the variation of E_{max} with *f*.



(i) A photon with frequency 10.0×10^{14} Hz is incident on the metal surface causing a photoelectron to be released.

Calculate the maximum possible velocity v_{max} of the photoelectron.

(2)

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v_{max} = ...

(ii) The table shows the work function ϕ for three metals.

Metal	ϕ / eV
caesium	2.2
zinc	4.3
beryllium	5.0

Deduce which metal was used in this demonstration.

(3)

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(Total for question = 5 marks)

Q5.

A student was studying musical instruments.

A guitar player changes the length of string that vibrates by pressing on the string as shown.

The guitar player plucks a string to play a note. A standing wave with one antinode is set up on the string.

He can vary the length of string that vibrates from 21 cm to 63 cm.

Deduce whether a note of frequency 196 Hz can be played on the string.

tension in string = 56 N
mass per unit length of the string = 5.0 Ã— 10^{-3} kg m^{-1}

(4)

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(Total for question = 4 marks)

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