External assessment 2024

**Multiple choice question book**

# Physics Alternative Sequence

## Paper 1

**General instruction**

- Work in this book will not be marked.

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

# Section 1

## Instruction

- Respond to these questions in the question and response book.

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### QUESTION 1

Power dissipation in an electric circuit is

(A) a rate at which energy is lost from the circuit.

(B) the ratio of the voltage applied as the electric current flows through it.

(C) the ratio of useful work performed by a component to total energy expended.

(D) the energy inputs in a circuit that equal the sum of energy output from loads in the circuit.

### QUESTION 2

As a substance undergoes a phase change from a solid to a liquid, the temperature remains the same.

The kinetic energy of the particles

(A) increases.

(B) decreases.

(C) remains constant.

(D) either increases or decreases, depending on the substance.

### QUESTION 3

A light source has an intensity of magnitude $10^{1}$ W m$^{-2}$ at a distance of 1.5 m.

What is the magnitude of the light intensity at 150 m?

(A) $10^{5}$ W m$^{-2}$

(B) $10^{-1}$ W m$^{-2}$

(C) $10^{-3}$ W m$^{-2}$

(D) $10^{-5}$ W m$^{-2}$

## QUESTION 4

Two experiments were conducted, and the following observations were made.

| | |
|---|---|
| **Experiment 1** | Light passing through a double slit produces a diffraction pattern. |
| **Experiment 2** | Above a specific frequency, light incident on a metallic surface produces photoelectrons with discrete amounts of energy. |

Which statement can be supported by the observations?

(A) A wave theory of light can completely describe the nature of light.

(B) The bending of light is a result of light behaving as a particle.

(C) The particle model only describes some properties of light.

(D) Only light waves can travel in a vacuum.

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## QUESTION 5

The magnitude of the electrostatic force between two positively charged particles

(A) is inversely proportional to the square of the distance between the particles.

(B) increases as the square of the distance between the particles increases.

(C) is proportional to the square of the distance between the particles.

(D) is unrelated to the square of the distance between the particles.

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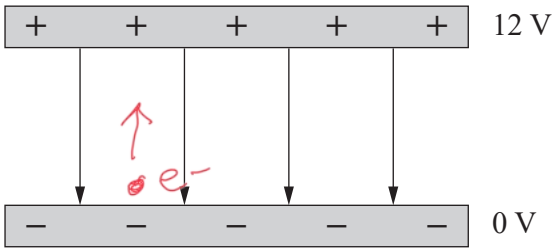
## QUESTION 6

Two metal plates are set up to create a uniform electric field as shown.

An electron is placed near the bottom plate and begins to move upwards.




As the electron moves towards the positive plate, its electrical potential energy

(A) increases.

(B) decreases. $E_K$ INC : $E_p$ DEC.

(C) remains constant at 0 V.

(D) remains constant at 12 V.

## QUESTION 7

Specific latent heat is the total energy transferred to

(A) a substance with no temperature change. Definition

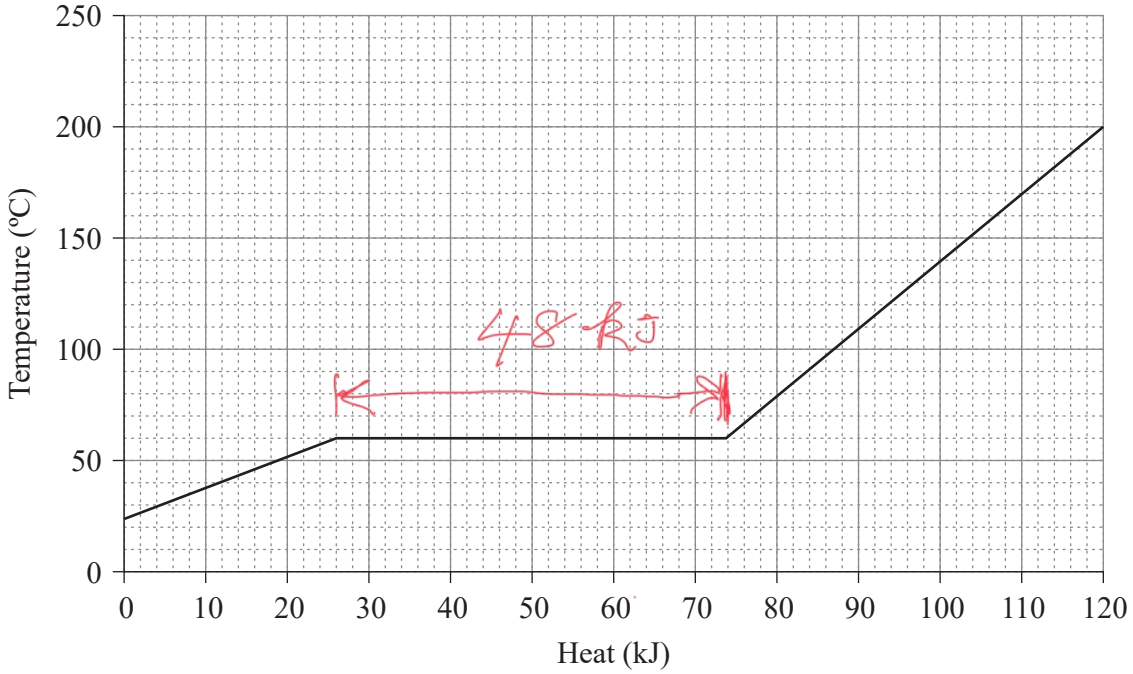
(B) a substance because of a difference in temperature. "HEAT"

(C) 1 kg of a substance to raise its temperature by 1 °C. SPECIFIC HEAT CAP

(D) change the state of 1 kg of a substance with no temperature change. ×
Phase change

## QUESTION 8

A liquid with a mass of 250 g was heated for 20 minutes and the temperature measured as shown.




What is the latent heat of vaporisation of the liquid?

$L_f = \frac{Q}{m} = \frac{48 \times 10^3 \text{ J}}{0.250}$

$= 192\,000$

$192 \text{ kJ/kg}$

(A) 0.19 kJ kg$^{-1}$ mass left = 9

(B) 12 kJ kg$^{-1}$ $48 \times 10^3 \times \frac{1}{4} = 12 \times 10^3$

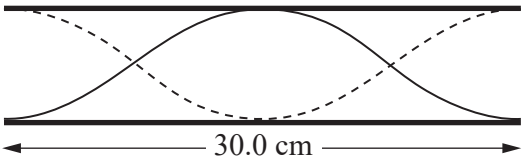
(C) 190 kJ kg$^{-1}$

(D) 300 kJ kg$^{-1}$

## QUESTION 9

A standing sound wave was created in air in an open pipe at 25 °C as shown.

Not to scale




$L = \frac{n\lambda}{2}$ $\lambda = \frac{2L}{1}$

Calculate the frequency of the standing wave.

(A) 288 Hz

(B) 577 Hz

(C) 865 Hz

(D) 1150 Hz $\frac{346}{0.3} = 1150$ Hz

$\lambda = 2 \times 0.30 = 0.60\,m$

$f = \frac{v}{\lambda} = \frac{346}{0.60}$

$= 577$ Hz

## QUESTION 10

An experiment was conducted to determine the force experienced by an 85 cm wire with a 2.4 A current flowing through it in an external magnetic field. It was rotated through varying angles within the magnetic field such that data analysis identified the relationship $F = 0.0306 \sin\theta$.

What is the order of magnitude of the strength of the external magnetic field?

(A) $10^{-4}$ T

(B) $10^{-2}$ T

(C) $10^{2}$ T

(D) $10^{4}$ T

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## QUESTION 11

Convert 234.5 K into °C.

(A) 507.5 °C

(B) 38.5 °C $273 - 234.5$

(C) –38.5 °C $234.5 - 273$

(D) –507.5 °C

$T_C = T_K + 273$

$= 234.5 + 273$

$= 507.5\ ^\circ C$

$T_K = T_C - 273 \Rightarrow T_C = -T_K - 273$

$= -234.5 - 273$

$= -507.5\ ^\circ C$

## QUESTION 12

Calculate the work done when an electrical appliance operates for 5.0 minutes at 210 V while drawing a current of 1.7 A.

(A) 1.2 J

(B) 360 J

(C) 1800 J

(D) 110 000 J

$W = VIt$
$= 210 \times 1.7 \times 5.0 \times 60$
$= 107100$
$= 110000$

## QUESTION 13

Light with a frequency of $9.4 \times 10^{15}$ Hz is incident upon an unknown metal, producing photoelectrons with a maximum kinetic energy of $5.6 \times 10^{-18}$ J.

What is the work function of the metal?

(A) 1.0 eV

(B) 3.9 eV

(C) 5.9 eV

(D) 6.3 eV

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## QUESTION 14

Magnetic flux density is a quantity related to the

(A) rate of change of field lines moving through a given area.

(B) number of magnetic field lines per unit area.

(C) volume occupied by a magnetic field.

(D) mass–charge ratio of a magnet.

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## QUESTION 15

Define efficiency.

EQBM

(A) The condition of a machine or process in which total thermal energy expended or heat loss is equal to zero.

(B) The ratio of useful work performed by a machine or in a process to total energy expended or heat taken in.

$\Delta Q = 0$

(C) The condition of a system in which there is no net exchange of thermal energy between any of the system components.

U Q

(D) The ratio of internal energy present in a system due to its temperature to the amount of thermal energy transferred when heating or cooling a substance.

$\frac{U}{\Delta Q}$

## QUESTION 16

A light wave of wavelength 555 nm is shone from water onto glass. The refractive index of water is 1.33, and the refractive index of the glass is 1.50. Calculate the wavelength of the light in the glass.

(A) 492 nm

(B) 554 nm

(C) 555 nm

(D) 625 nm

$= \frac{555 \times 1.5}{1.33}$

$n_{12} = \frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1}$

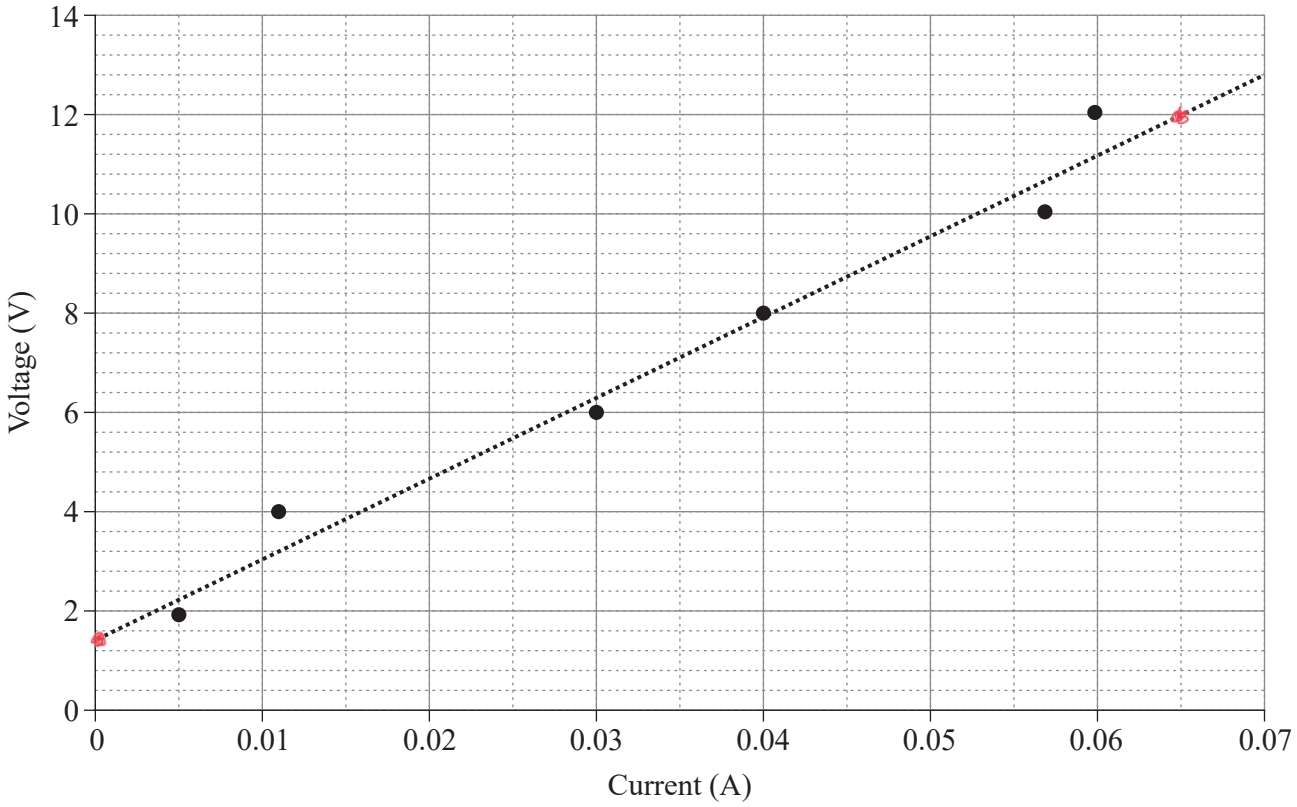
$\Rightarrow \frac{\lambda_w}{\lambda_g} = \frac{n_g}{n_w}$

$\frac{555}{\lambda_g} = \frac{1.50}{1.33}$

$\lambda_g = 492\,nm$

## QUESTION 17

Experimental data was collected and graphed to determine the resistance of a light bulb.




What is the resistance of the light bulb?

$R = \frac{\Delta V}{\Delta I} = \frac{12 - 1.4}{0.065 - 0} = \frac{10.6}{0.065} = 163\,\Omega$

(A) $1.6 \times 10^2\ \Omega$

(B) $1.8 \times 10^2\ \Omega$

(C) $2.0 \times 10^2\ \Omega$

(D) $6.2 \times 10^2\ \Omega$

$R \neq \frac{12}{0.065}$ POINT ON LINE

$R \neq \frac{12}{0.06}$ LAST DATA POINT

$= 200\,\Omega$

$R = 620\,\Omega$ ??

## QUESTION 18

Electromagnetic waves are produced by an oscillating electric charge resulting in an interaction between magnetic and electric fields.

How are these two fields aligned?

(A) parallel to each other

(B) varied in their wavelengths

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(C) synchronised in their oscillations

(D) intersected at the peaks of their amplitudes

## QUESTION 19

A 7 μC charge requires $1.5 \times 10^{-8}$ J of energy to be moved between two points in an electric field.

What is the order of magnitude of the potential difference between the two points?

(A) $10^{-2}$ V

(B) $10^{-3}$ V

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(C) $10^{-9}$ V

(D) $10^{-13}$ V

## QUESTION 20

Identify the defining feature of a black body.

(A) All frequencies of electromagnetic radiation are absorbed and emitted.

(B) Light with two wavelength peaks is emitted at a specific temperature.

(C) Electrons are emitted in the presence of all frequencies of light.

(D) The peak of its spectral output does not vary with temperature.

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