

External assessment 2024

Multiple choice question book

Physics

Paper 1

General instruction

- Work in this book will not be marked.



Queensland
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Section 1

Instruction

- Respond to these questions in the question and response book.
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QUESTION 1

Which option describes a feature of baryons?

- (A) eliminated by positrons
- (B) comprised of three quarks
- (C) a type of elementary particle
- (D) electrical charge equates to $+\frac{2}{3}e^-$

QUESTION 2

Which property of light is described by the postulates of special relativity?

- (A) The energy of light is greater when the frequency of the photons decreases.
- (B) The wavelength of light decreases as the velocity of the source increases.
- (C) The velocity of light remains constant in all inertial frames of reference.
- (D) The frequency of light changes depending on media.

QUESTION 3

Two objects with masses 65.0 kg and 75.0 kg respectively are separated by 1.50 m.

What is the gravitational force of attraction between them?

- (A) 3.08×10^{-14} N
- (B) 3.25×10^{-7} N
- (C) 2.17×10^{-7} N
- (D) 1.45×10^{-7} N

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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.

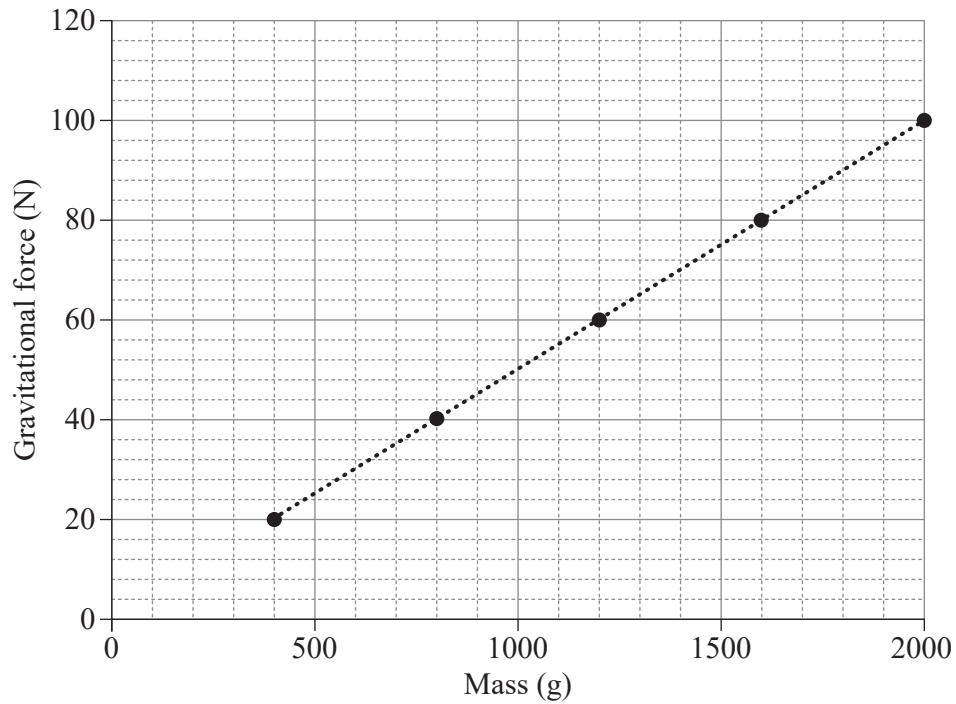
QUESTION 5

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.

QUESTION 6

The graph shows the relationship between the masses of different objects and the gravitational force they experience on an unknown planet's surface.



Determine the gravitational field strength for an object at the planet's surface.

- (A) 0.02 m s^{-2}
- (B) 0.05 m s^{-2}
- (C) 20 m s^{-2}
- (D) 50 m s^{-2}

QUESTION 7

An object experiencing a gravitational force of 50.0 N moves down a frictionless incline of 40.0° to the horizontal.

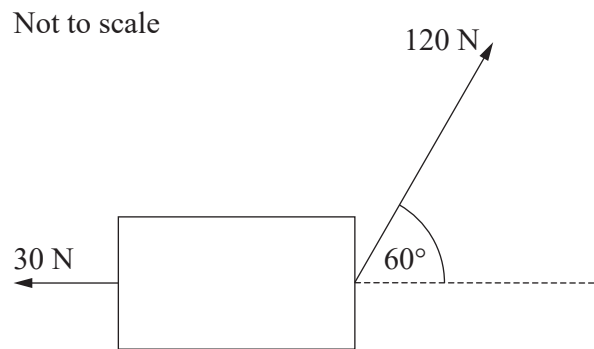
Calculate the net force acting on the object.

- (A) 32.1 N
- (B) 37.3 N
- (C) 38.3 N
- (D) 42.0 N

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QUESTION 8

An object is pulled in two different directions as shown.

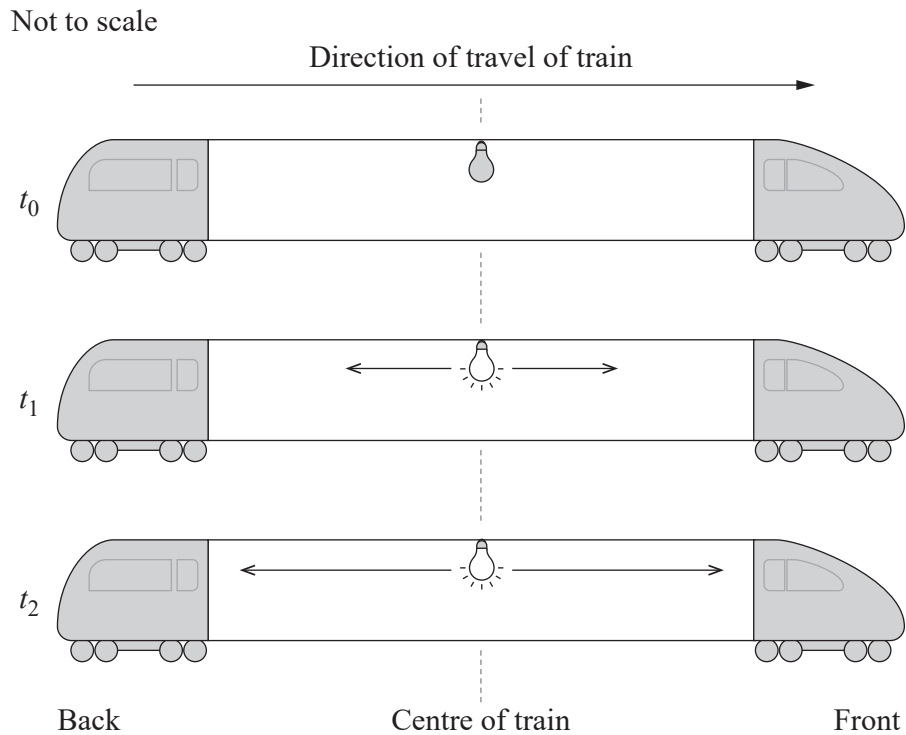


What is the magnitude of the net horizontal force acting on the object?

- (A) 100 N
- (B) 90 N
- (C) 70 N
- (D) 30 N

QUESTION 9

A passenger at the centre of a train moving at a relativistic speed switches on a light. According to the passenger, light travels outwards as shown.



How would a stationary observer, watching the train pass by them, record this event?

- (A) Light will reach the back of the train first.
- (B) Light will reach the front of the train first.
- (C) Light will reach both ends of the train at t_0 .
- (D) Light will reach both ends of the train simultaneously.

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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

QUESTION 11

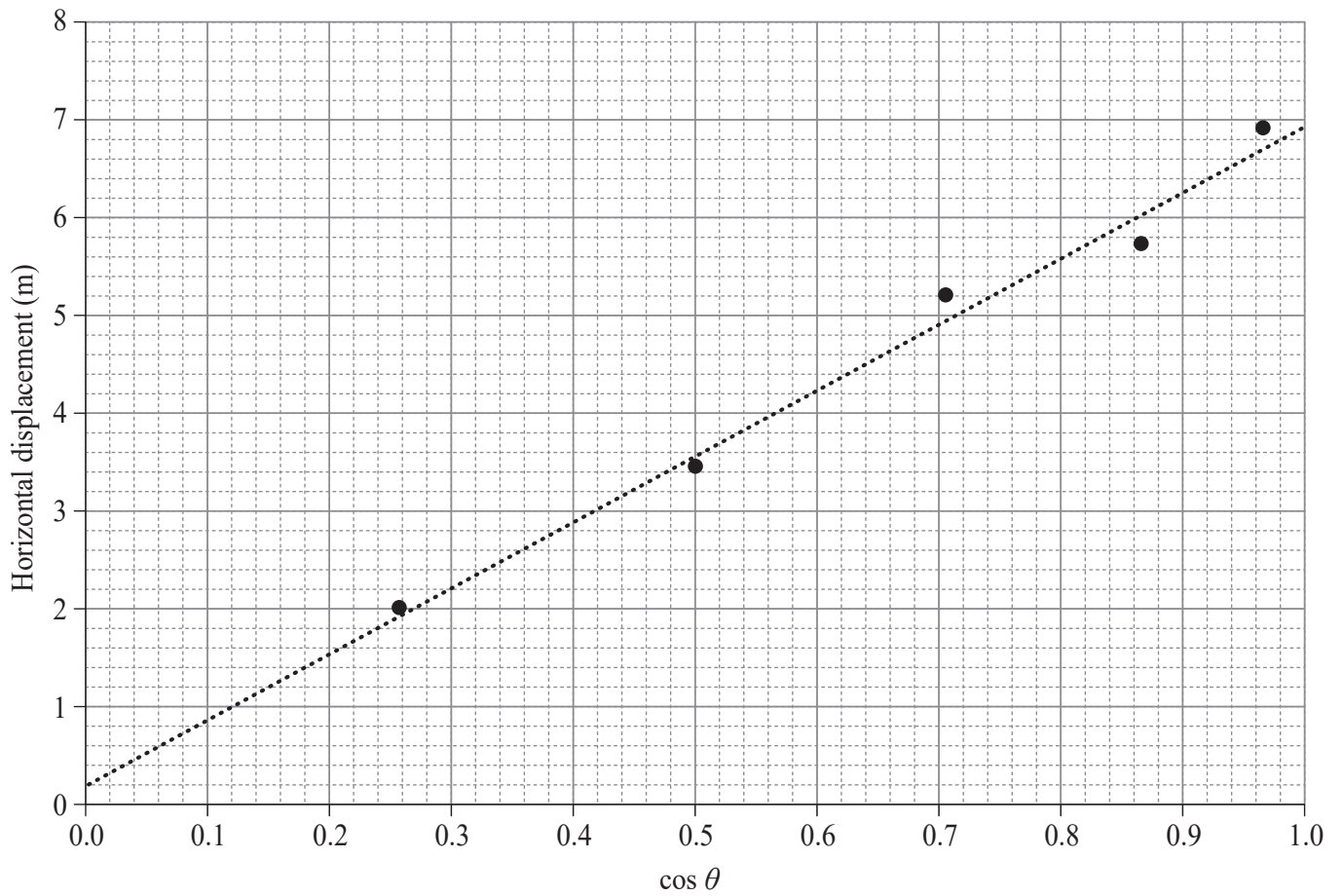
A planet orbiting a star has an orbital radius of 6.4×10^{14} m and completes a full revolution every 1.5 Earth years.

What is the mass of the star?

- (A) 2.0×10^{17} kg
- (B) 8.0×10^{18} kg
- (C) 6.9×10^{40} kg
- (D) 3.3×10^{48} kg

QUESTION 12

The horizontal displacement of an object experiencing projectile motion was measured and recorded against the cosine of the launch angle (i.e. the angle up from the horizontal). The initial velocity was kept constant.



What launch angle would cause the object to land 1.0 m from its starting position?

- (A) 0.12°
- (B) 1.0°
- (C) 6.9°
- (D) 83°

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QUESTION 13

Light with a frequency of 9.4×10^{15} Hz is incident upon an unknown metal, producing photoelectrons with a maximum kinetic energy of 5.6×10^{-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

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.

QUESTION 15

In which direction does the centripetal force act?

- (A) towards the centre of motion
- (B) away from the centre of motion
- (C) opposite to the object's direction of motion
- (D) tangentially to the object's direction of motion

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QUESTION 16

The table shows a combination of mediating particles and possible forces they experience. Which row is correct?

	Particle	Strong nuclear force	Weak nuclear force	Electromagnetic force
(A)	Photon	✓	✓	✓
(B)	Lepton	✓	✓	
(C)	Quark	✓		✓
(D)	Meson	✓	✓	✓

QUESTION 17

A person on Earth experiences a time period of 15 years.

Approximately how much time will have passed for a passenger on a spaceship travelling at $0.7c$ relative to Earth during that time?

- (A) 8 years
- (B) 11 years
- (C) 21 years
- (D) 27 years

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
- (C) synchronised in their oscillations
- (D) intersected at the peaks of their amplitudes

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QUESTION 19

A $7 \mu\text{C}$ charge requires $1.5 \times 10^{-8} \text{ J}$ 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
- (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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