

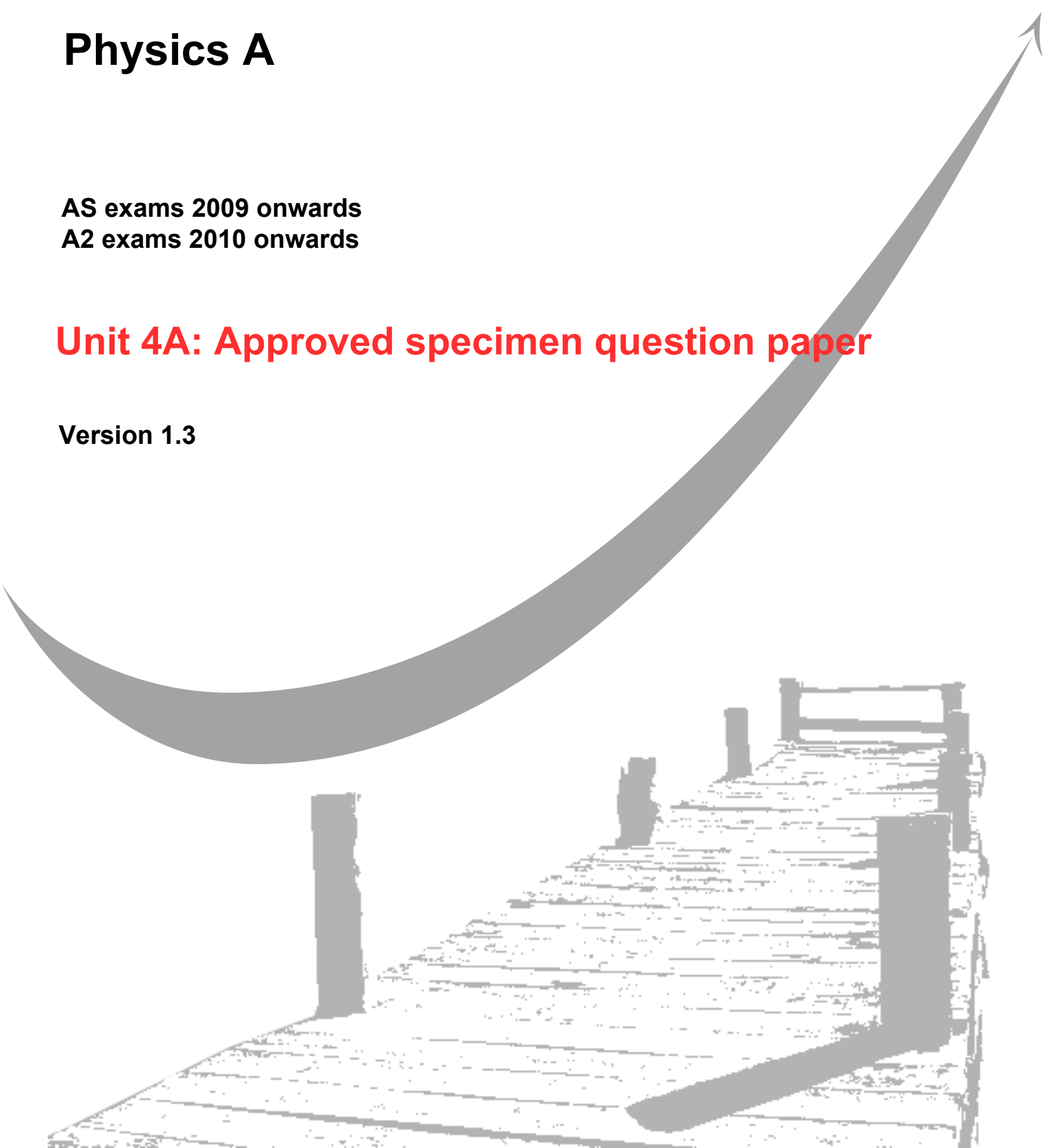
GCE
AS and A Level

Physics A

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 4A: Approved specimen question paper

Version 1.3



General Certificate of Education
2010
Advanced Examination



version 1.3

PHYSICS A
Unit 4: Fields and Further Mechanics

PHYA4/1

Section A

SPECIMEN PAPER

For this paper you must have:

- an objective test answer sheet
- black ball-point pen
- a calculator
- a question paper/answer book for Section B (enclosed)

Instructions

- Use a black ball-point pen. Do **not** use pencil.
- Answer **all** questions in this section.
- For each question there are four responses. When you have selected the response which you think is the most appropriate answer to a question, mark this response on your answer sheet.
- Mark all responses as instructed on your answer sheet. If you wish to change your answer to a question, follow the instructions on your answer sheet.
- Do all rough work in this book **not** on the answer sheet.

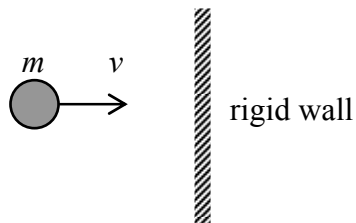
Information

- The maximum mark for this paper is 25.
- All questions in Section A carry equal marks. No deductions will be made for incorrect answers.
- *A Data and Formulae Booklet* is provided as a loose insert.
- The question paper/answer book for Section B is enclosed within this question paper.

1 For the two physical quantities, impulse and force, which one of the following is correct?

- A Impulse is a scalar and force is a scalar.
- B Impulse is a scalar and force is a vector.
- C Impulse is a vector and force is a scalar.
- D impulse is a vector and force is a vector.

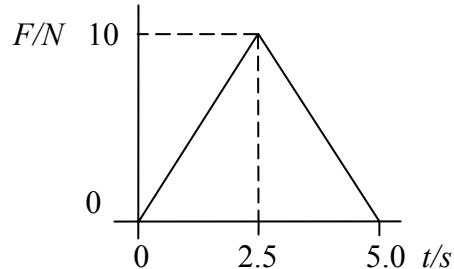
2 A particle of mass m strikes a rigid wall perpendicularly from the left with velocity v .



If the collision is perfectly elastic, the change in momentum of the particle which occurs as a result of the collision is

- A $2mv$ to the right.
- B $2mv$ to the left.
- C mv to the left.
- D zero.

3



A force, F , varies with time, t , as shown by the graph and is applied to a body initially at rest on a smooth surface. What is the momentum of the body after 5.0 s?

- A zero.
- B 12.5 N s.
- C 25 N s.
- D 50 N s.

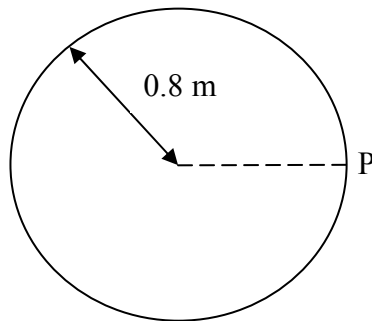
4 The rate of change of momentum of a body falling freely under gravity is equal to its

- A weight.
- B power.
- C kinetic energy.
- D potential energy.

5 What is the value of the angular velocity of a point on the surface of the Earth?

- A $1.2 \times 10^{-5} \text{ rad s}^{-1}$
- B $7.3 \times 10^{-5} \text{ rad s}^{-1}$
- C $2.6 \times 10^{-1} \text{ rad s}^{-1}$
- D $4.6 \times 10^2 \text{ rad s}^{-1}$

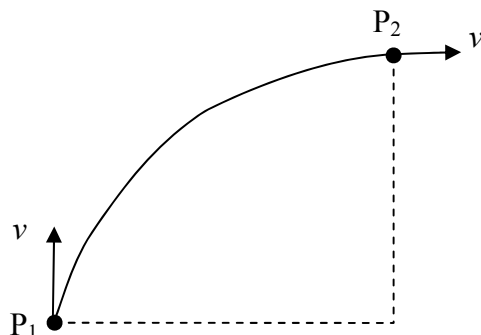
6



A model car moves in a circular path of radius 0.8 m at an angular speed of $\frac{\pi}{2} \text{ rad s}^{-1}$. What is its displacement from point P, 6 s after passing P?

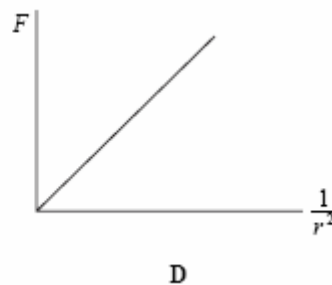
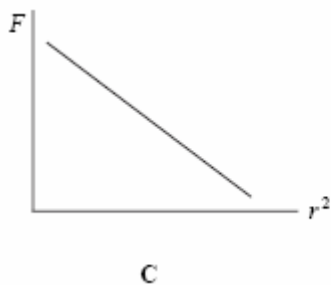
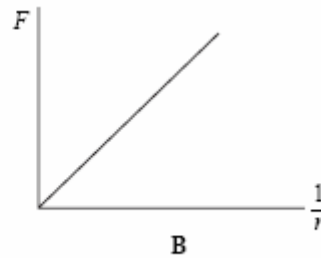
- A zero
- B 1.6 m
- C $0.4 \pi \text{ m}$
- D $1.6 \pi \text{ m}$

- 7 A particle of mass m moves horizontally at constant speed v along the arc of a circle from P_1 to P_2 under the action of a force. What is the work done on the particle by the force during this displacement?



- A** zero
- B** $\frac{\pi m v^2}{2}$
- C** $m v^2 \sqrt{2}$
- D** $2 m v^2$
- 8 A body moves with simple harmonic motion of amplitude 0.50 m and period 4π seconds. What is the speed of the body when the displacement of the body from the equilibrium position is 0.30 m?
- A** 0.10 m s^{-1}
- B** 0.15 m s^{-1}
- C** 0.20 m s^{-1}
- D** 0.40 m s^{-1}
- 9 The time period of a simple pendulum is doubled when the length of the pendulum is increased by 3.0 m. What is the original length of the pendulum?
- A** 1.0 m
- B** 1.5 m
- C** 3.0 m
- D** 6.0 m

- 10 Which one of the following statements is **not** true for a body vibrating in simple harmonic motion when damping is present?
- A The damping force is always in the opposite direction to the velocity.
 - B The damping force is always in the opposite direction to the displacement.
 - C The presence of damping gradually reduces the maximum potential energy of the system.
 - D The presence of damping gradually reduces the maximum kinetic energy of the system.
- 11 The Earth has density ρ and radius R . The gravitational field strength at the surface is g . What is the gravitational field strength at the surface of a planet of density 2ρ and radius $2R$?
- A g
 - B $2g$
 - C $4g$
 - D $16g$
- 12 Which one of the following graphs correctly shows the relationship between the gravitational force, F , between two masses and their separation, r ?



13 Near the surface of a planet the gravitational field strength is uniform and for two points, 10 m apart vertically, the gravitational potential difference is 3 J kg^{-1} . How much work must be done in raising a mass of 4 kg vertically through 5 m?

- A** 3 J
- B** 6 J
- C** 12 J
- D** 15 J

14 Two isolated point charges are separated by 0.04 m and attract each other with a force of $20 \mu\text{N}$. If the distance between them is increased by 0.04 m, what is the new force of attraction?

- A** $5 \mu\text{N}$
- B** $10 \mu\text{N}$
- C** $20 \mu\text{N}$
- D** $40 \mu\text{N}$

15 Two protons, each of mass m and charge e , are a distance d apart. Which one of the following expressions correctly gives the ratio $\left(\frac{\text{electrostatic force}}{\text{gravitational force}}\right)$ for the forces acting between them?

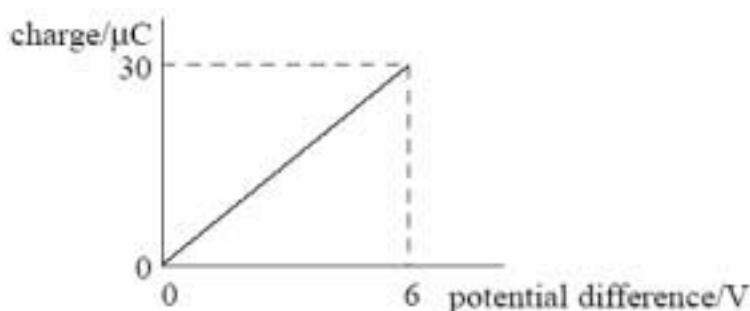
- A** $\frac{4\pi\epsilon_0 e^2}{Gm^2}$
- B** $\frac{Ge^2}{4\pi\epsilon_0 m^2}$
- C** $\frac{e^2 m^2}{4\pi\epsilon_0 G}$
- D** $\frac{e^2}{4\pi\epsilon_0 Gm^2}$

16 An electron travelling at constant speed enters a uniform electric field at right angles to the field. While the electron is in the field it accelerates in a direction which is

- A** in the same direction as the electric field
- B** in the opposite direction to the electric field
- C** in the same direction as the motion of the electron
- D** in the opposite direction to the motion of the electron

- 17 Which one of the following statements about electric potential and electric field strength is correct?
- A electric potential is zero whenever the electric field strength is zero
 - B electric field strength is a scalar quantity
 - C electric potential is a vector quantity
 - D electric potential due to a point charge varies as $(1/r)$ where r is the distance from the point charge
- 18 A $1000 \mu\text{F}$ capacitor and a $10 \mu\text{F}$ capacitor are charged so that the potential difference across each of them is the same. The charge stored in the $1000 \mu\text{F}$ capacitor is Q_1 and the charge stored in the $10 \mu\text{F}$ capacitor is Q_2 . What is the ratio $\frac{Q_1}{Q_2}$?
- A 100
 - B 10
 - C 1
 - D $\frac{1}{100}$
- 19 In experiments to pass a very high current through a gas, a bank of capacitors of total capacitance $50 \mu\text{F}$ is charged to 30kV . If the bank of capacitors could be discharged completely in 5.0 ms , what would be the mean power delivered?
- A 22 kW
 - B 110 kW
 - C 4.5 MW
 - D 9.0 MW

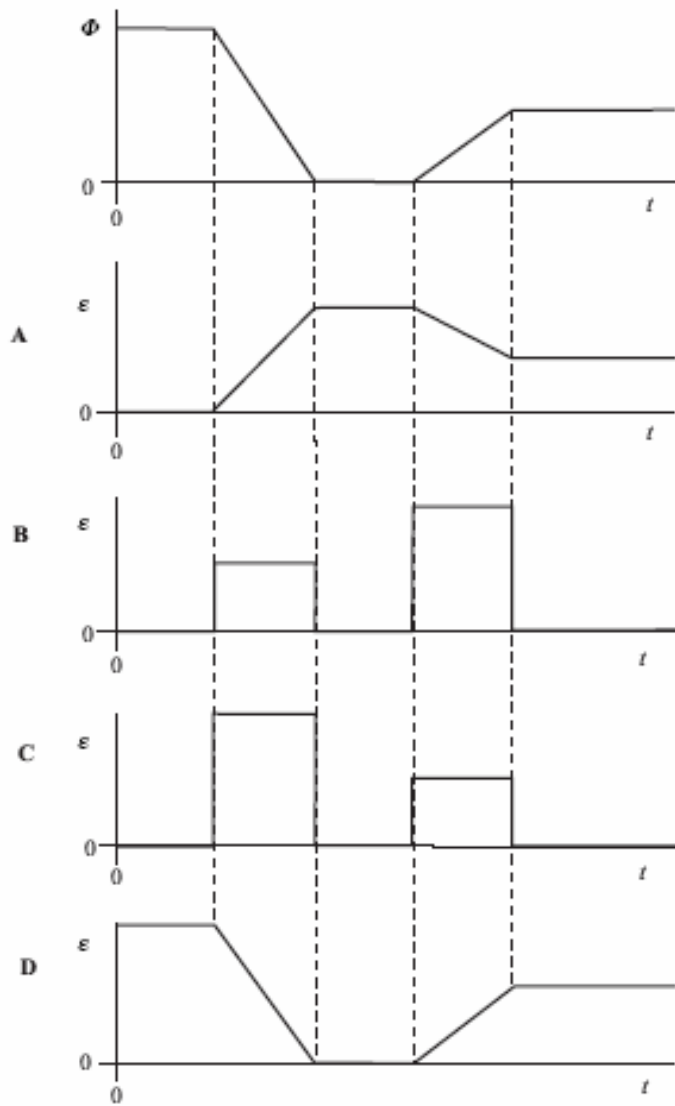
- 20 The graph shows how the charge stored by a capacitor varies with the potential difference across it as it is charged from a 6 V battery.



Which one of the following statements is **not** correct?

- A The capacitance of the capacitor is $5.0 \mu\text{F}$.
- B When the potential difference is 2 V the charge stored is $10 \mu\text{C}$.
- C When the potential difference is 2 V the energy stored is $10 \mu\text{J}$.
- D When the potential difference is 6 V the energy stored is $180 \mu\text{J}$.

- 21 The magnetic flux, Φ , through a coil varies with time, t , as shown by the first graph. Which one of the following graphs, A to D, best represents how the magnitude, \mathcal{E} , of the induced emf varies in this same period of time?



22 Protons, each of mass m and charge e , follow a circular path when travelling perpendicular to a magnetic field of uniform flux density B . What is the time taken for one complete orbit?

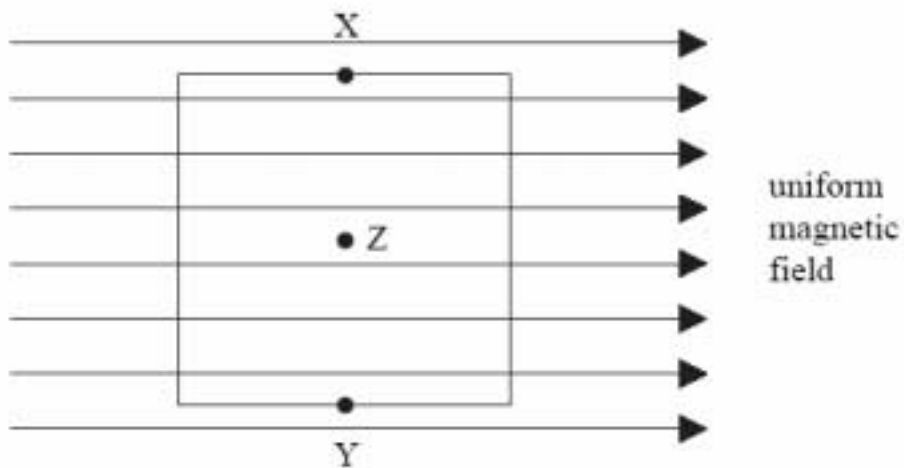
A $\frac{2\pi eB}{m}$

B $\frac{m}{2\pi eB}$

C $\frac{eB}{2\pi m}$

D $\frac{2\pi m}{eB}$

23



The diagram shows a square coil with its plane parallel to a uniform magnetic field. Which one of the following would induce an emf in the coil?

- A movement of the coil slightly to the left
- B movement of the coil slightly downwards
- C rotation of the coil about an axis through XY
- D rotation of the coil about an axis perpendicular to the plane of the coil through Z

- 24 The primary winding of a perfectly efficient transformer has 200 turns and the secondary has 1000 turns. When a sinusoidal pd of rms value 10 V is applied to the input, there is a primary current of rms value 0.10 A rms. Which line in the following table, **A** to **D**, gives correct rms output values obtainable from the secondary when the primary is supplied in this way?

	rms output emf/V	rms output current/A
A	50	0.10
B	50	0.02
C	10	0.10
D	10	0.02

- 25 Why, when transporting electricity on the National Grid, are high voltages and low currents used?
- A** The energy lost by radiation from electromagnetic waves is reduced.
 - B** The electrons move more rapidly.
 - C** The heat losses are reduced.
 - D** The resistance of the power lines is reduced.