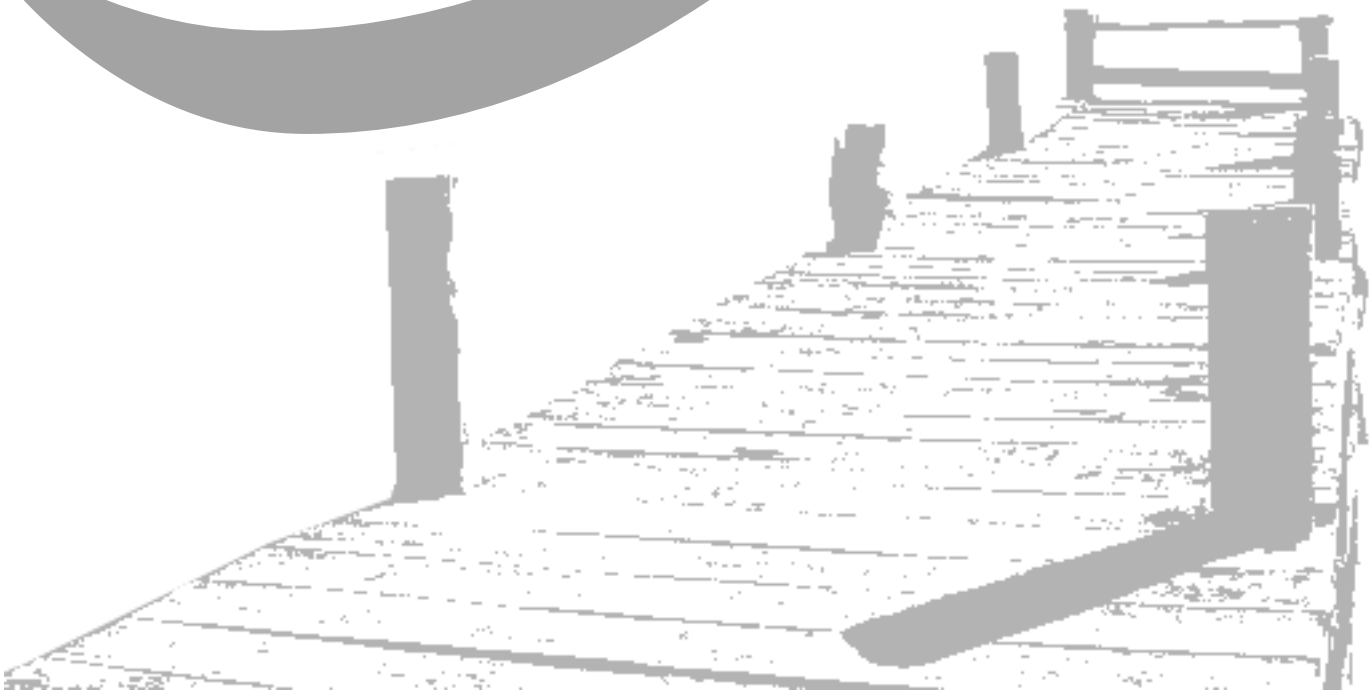
GCE
AS and A Level

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

ASSESSMENT and QUALIFICATIONS ALLIANCE

version 1.3

PHYSICS A PHYA4/1
Unit 4: Fields and Further Mechanics

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)

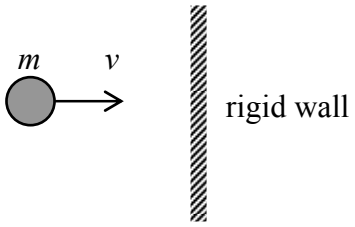
Instructions
- Use a black ball-point pen. Do **not** use pencil.
- Answer **all** questions in this section.
- For each question there are four responses. When you have selected the response which you think is the most appropriate answer to a question, mark this response on your answer sheet.
- Mark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

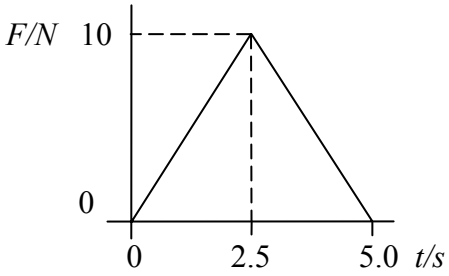
2 A particle of mass *m* strikes a rigid wall perpendicularly from the left with velocity *v*.



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

A 2*mv* to the right.
B 2*mv* 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.

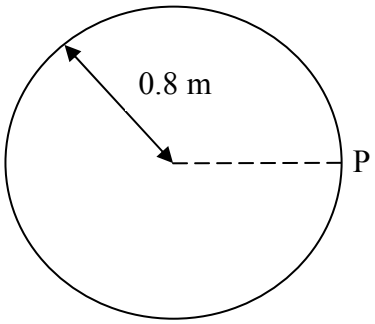
4 The rate of change of momentum of a body falling freely under gravity is equal to its

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 1.2×10^{-5} rad s^{-1}
B 7.3×10^{-5} rad s^{-1}
C 2.6 × 10-1 rad s^{-1}
D 4.6×10^{2} rad s^{-1}

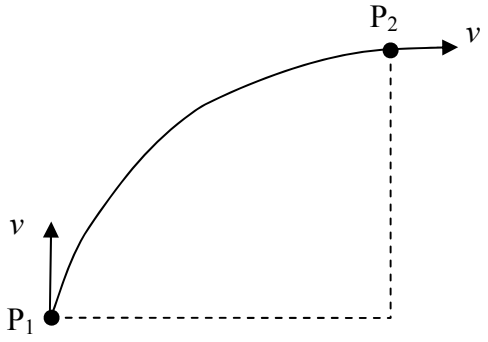
6



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

A zero
B 1.6 m
C 0.4 πm
D 1.6 πm

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 $mv^2\sqrt{2}$

D $2\,mv^2$

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 $0.10\ \text{m s}^{-1}$
B $0.15\ \text{m s}^{-1}$
C $0.20\ \text{m s}^{-1}$
D $0.40\ \text{m s}^{-1}$

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

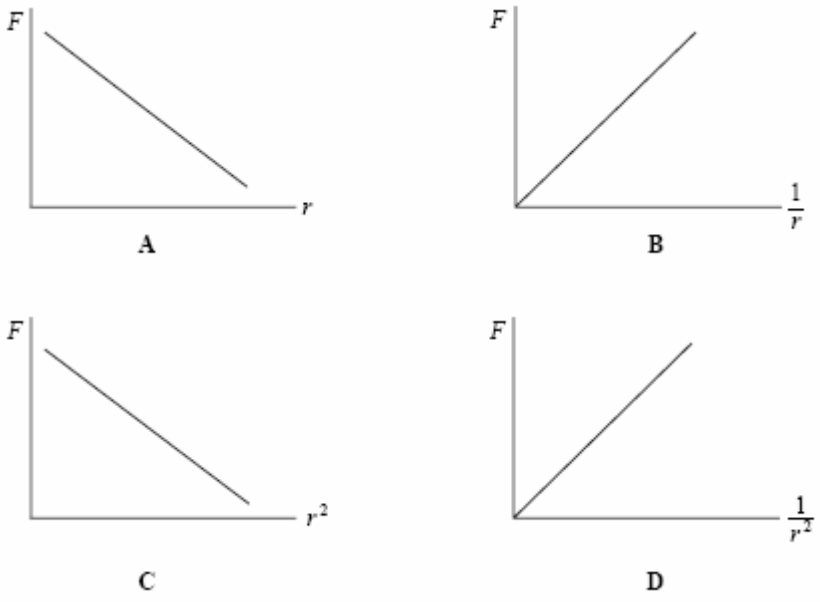
10 Which one of the following statements is **not** true for a body vibrating in simple harmonic motion when damping is present?

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 μN. If the distance between them is increased by 0.04 m, what is the new force of attraction?

A 5 μN
B 10 μN
C 20 μN
D 40 μN

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 $\frac{4\pi\varepsilon_0 e^2}{Gm^2}$

B $\frac{Ge^2}{4\pi\varepsilon_0 m^2}$

C $\frac{e^2m^2}{4\pi\varepsilon_0 G}$

D $\frac{e^2}{4\pi\varepsilon_0 Gm^2}$

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

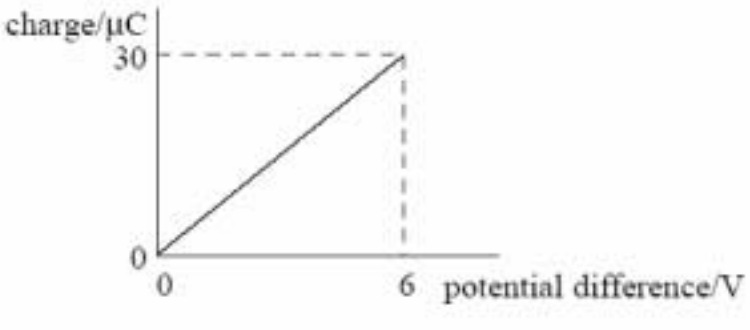
18 A 1000 μF capacitor and a 10 μF capacitor are charged so that the potential difference across each of them is the same. The charge stored in the 1000 μF capacitor is Q_1 and the charge stored in the 10 μF capacitor is Q_2. What is the ratio $\frac{Q_1}{Q_2}$?

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 μF 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

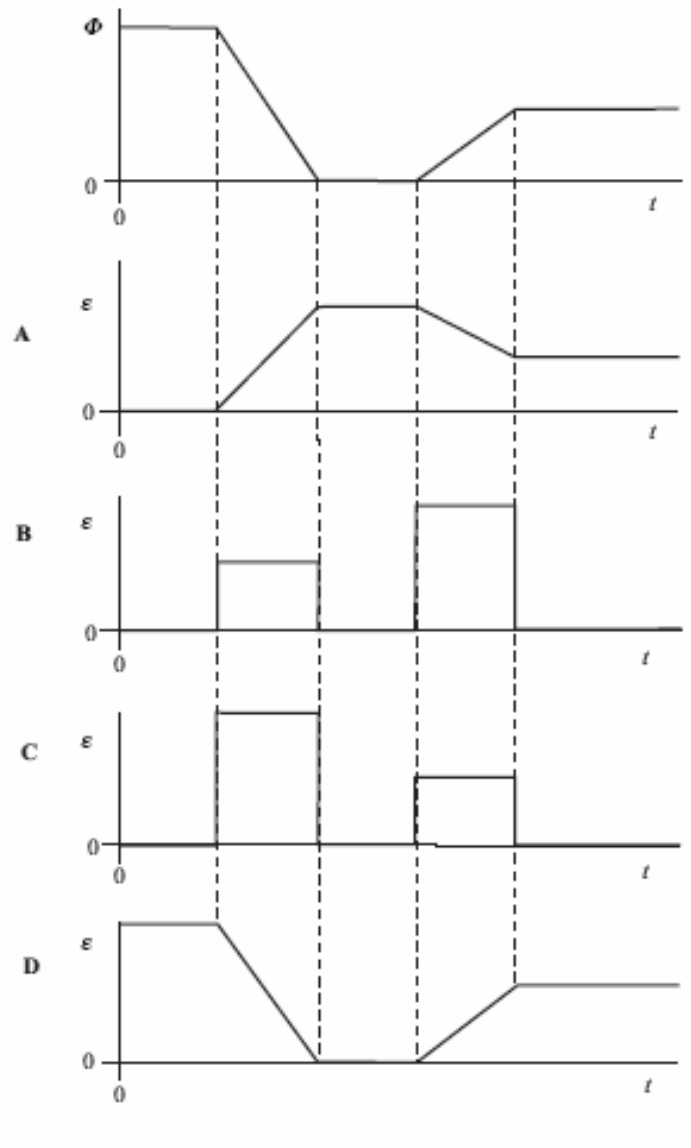
20 The graph shows how the charge stored by a capacitor varies with the potential difference across it as it is charged from a 6 V battery.



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

A The capacitance of the capacitor is 5.0 μF.
B When the potential difference is 2 V the charge stored is 10 μC.
C When the potential difference is 2 V the energy stored is 10 μJ.
D When the potential difference is 6 V the energy stored is 180 μJ.

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, ϵ, 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?

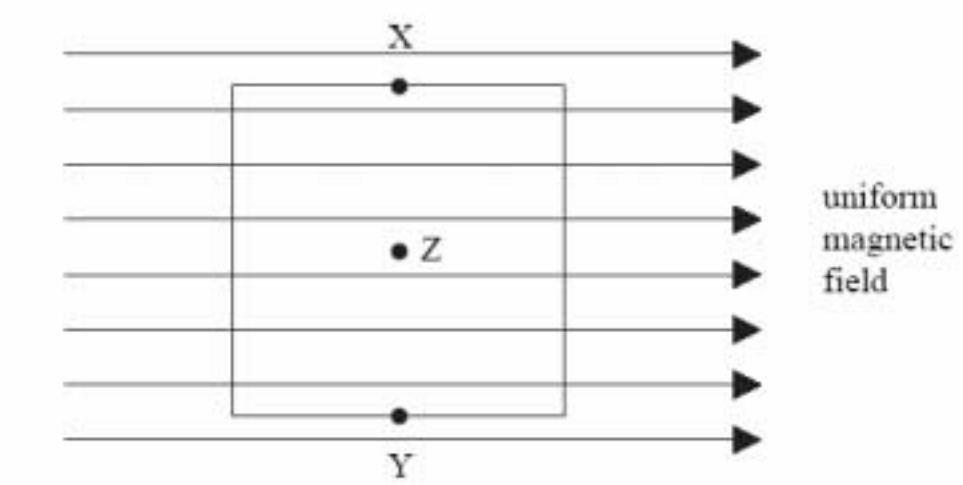
A $\dfrac{2\pi eB}{m}$

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

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

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

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.