Class	Student Number	Name

CAMBRIDGE A LEVEL PROGRAMME
AS TRIAL EXAMINATION AUGUST/SEPTEMBER 2009
(January & March 2009 Intakes)

Wednesday   **9 September 2009**   **8.30 am – 9.30 am**

PHYSICS   9702/12

PAPER 12 Multiple Choice   1 hour

Candidates answer on the Question Paper.
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil
Write your name, class and student number on the answer sheet in the spaces provided.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** questions in this paper. Answer **all** questions. For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record your choice in soft pencil on the separate answer sheet.

Read the instructions on the answer sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

This document consists of **12** printed pages.

[Turn over

1 Which one of the following groups contains three vector quantities?

   A displacement, velocity, energy
   B displacement, velocity, momentum
   C force, work, energy
   D velocity, acceleration, power

2 A metal sphere of radius r is dropped into a tank of water. As it sinks at speed v, it experiences a drag force F given by $F = krv$, where k is a constant.
What are the SI base units of k?

   A $kg\,m^2\,s^{-1}$ **B** $kg\,m^{-2}\,s^{-2}$ **C** $kg\,m^{-1}\,s^{-1}$ **D** $kg\,m\,s^{-2}$

3 Uncertainties in measurement may be either systematic or random.
Which of the following involves random uncertainty?

   A not allowing for zero uncertainty on a voltmeter

   B not subtracting background count rate when measuring count rate from a radioactive source

   C stopping a stopwatch at the end of a race

   D using the value $g = 10\ Nkg^{-1}$ when calculating weight from mass

4 A student uses a digital ammeter to measure a current. The reading of the ammeter is found to fluctuate between 1.98 A and 2.02 A.
The manufacturer of the ammeter states that any reading has a systematic uncertainty of $\pm 1\ \%$.
Which value of current should be quoted by the student?

   A (2.00 ± 0.01) A   **B** (2.00 ± 0.02) A   **C** (2.00 ± 0.03) A   **D** (2.00 ± 0.04) A

5 A car is travelling with a constant speed of $36\ m\ s^{-1}$. It takes 30 seconds to bring the car to a stop by applying the brakes. How far does the car travel during this time?

   A 1080 m   **B** 810 m   **C** 540 m   **D** 270 m

6 Two bodies are allowed to fall freely from the same location, one of which is released a short time before the other. If air resistance is neglected, while they are falling,
   (1) the two bodies have the same acceleration.
   (2) their speeds always differ by the same amount.
   (3) their distance of separation is always the same.

The correct statements are

   A (1), (2) and (3)   **B** (1) and (2) only   **C** (2) and (3) only   **D** (1) only

7 An object is projected vertically upwards from the earth's surface. The object achieves maximum height before falling to the earth. If air friction is negligible, which of the following statements is true of the object's motion in air?

   A The object's acceleration is constant along its entire motion.

   B The object's velocity is not zero at maximum height.

   C The object's linear momentum variation is zero.

   D The object's average speed is zero.

8 A small part of the earth's gravitational field close to the surface of the earth is uniform.
Which of the following statements is **correct**?

   A The field lines are parallel to each other.

   B Two different masses may have same weight.

   C The weight of an object is proportional to its height above the earth's surface.

   D The direction of the field lines is horizontal.

9 The diagram shows two trolleys X and Y held stationary and connected by an elastic cord. The mass of X is twice that of Y.
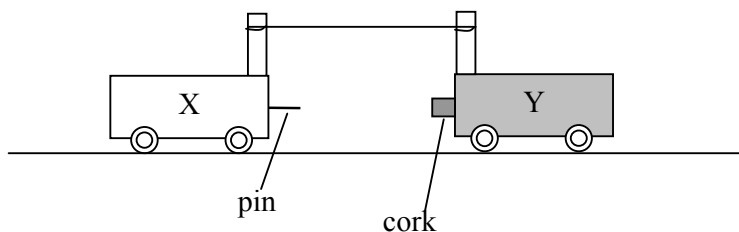

The trolleys are released at the same instant. They move towards each other and stick together on impact. Just before collision, the speed of X is 20 cm s^{-1}.
What is the speed of Y just after the collision?

   A zero   **B** 5 cm s^{-1} **C** 7 cm s^{-1} **D** 10 cm s^{-1}

10 A car is moving on a horizontal road. There are four forces.

   W : the air resistance
   X : the force exerted by the engine
   Y : the contact force of the car on the ground
   Z : the contact force of the ground on the car

Which pair of forces **must always** have the same magnitude?

   A Y and Z   **B** W and X   **C** X and Y   **D** W and Z

11 The diagram shows a trolley being pulled from rest along a horizontal table by a falling mass. The trolley mass is 1.5 kg and the falling mass falls through 1.0 m.
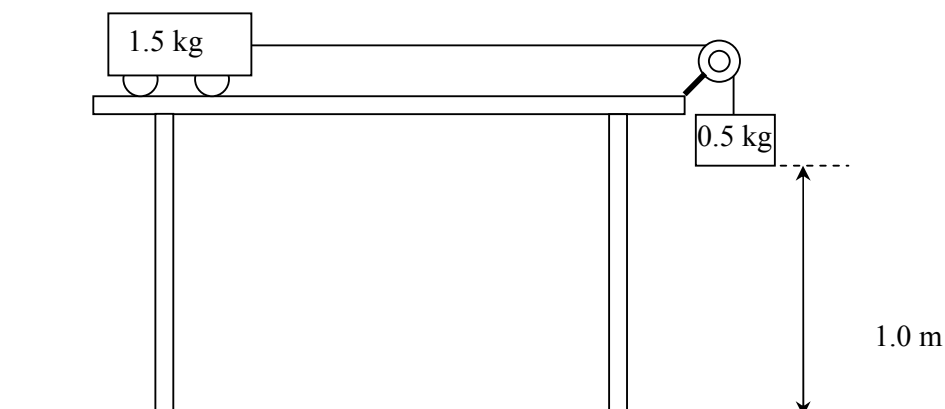

What is the maximum kinetic energy of the trolley?

A   3.7 J   **B**   4.9 J   **C**   15 J   **D**   20 J

12 An aircraft moving through air at velocity v experiences a resistive force F given by the expression

$F = kv^2$, where k is a constant.

What is the power required to keep the aircraft moving at this constant speed?

A kv **B** kv^2 **C** kv^3 **D** kv^4

13 A small electric motor is used to raise a mass of weight 2.0 N at a constant velocity through a vertical height of 80 cm in 4.0 s. The efficiency of the motor is 20%.
What is the electrical power supplied to the motor?

A 0.080 W   **B** 0.80 W   **C** 2.0 W   **D** 200 W

14 A uniform loft door of weight W and length 0.8 m is in equilibrium. It is hinged at X and supported by a rope passing over a pulley. The tension in the supporting rope is T. Which of the following equations applies when moments are taken about X?
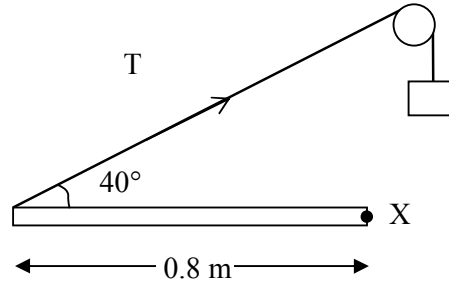

A $T \sin40^\circ = 0.4W$

B $0.8T \cos50^\circ = 0.4W$

C $0.8T = 0.4W$

D $2T \sin50^\circ = W$

15 A load is to be moved using a wheelbarrow. The total mass of the load and wheelbarrow is 60 kg. Assume the weight of the wheelbarrow and load acts through the same point. (Take g=10 ms^{-2})
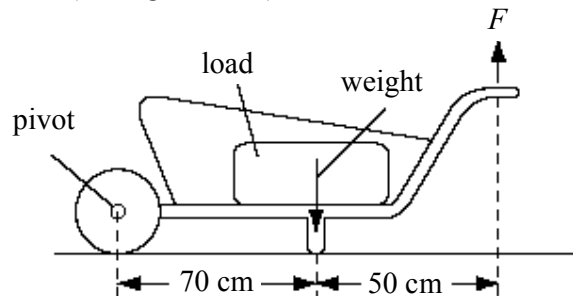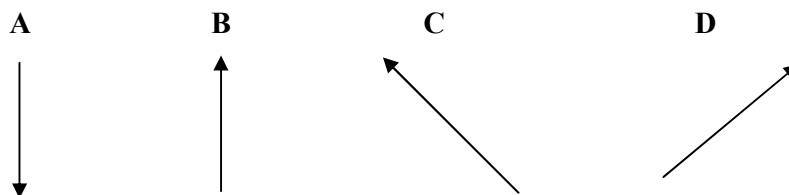

What is the size of force F needed just to lift the loaded wheelbarrow?

A 350 N   **B** 430 N   **C** 600 N   **D** 840 N

[Turn over

16 The figure below shows three forces acting at a point in equilibrium.

F_1

F_3

F_2
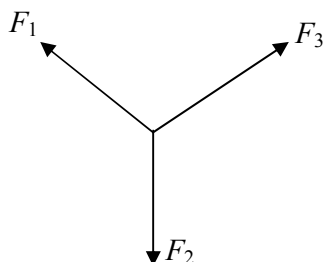
Which of the following represents the resultant of the forces when F_2 is removed?

A   **B**   **C**   **D**

17 A piece of copper is drawn into a continuous wire.
What behaviour is the copper exhibiting?

A brittle only   **B** elastic only   **C** plastic only   **D** both brittle and plastic

18 The table summarises some properties of evaporation.
Which row of the table is correct?

	Involves a change in state from liquid to vapour	Occurs at a fixed temperature	Involves a reduction in the average kinetic energy of the remaining atoms
A	true	true	true
B	true	false	true
C	true	false	false
D	false	true	false

19 A wire stretches 8.0 mm under a load of 60 N.
A second wire of the same material, with half the diameter and a quarter of the original length of the first wire, is stretched by the same load.
Assuming that Hooke's law is obeyed, what is the extension of this wire?

A 0.5 mm   **B** 1.0 mm   **C** 4.0 mm   **D** 8.0 mm

20 A spring extends by 4 cm when 10 N is suspended from it. Two of these springs are used as shown to carry a 30 N load.
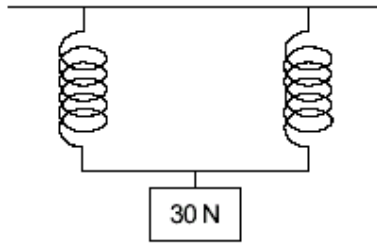
What is the extension of each spring?

A 4 cm   **B** 6 cm   **C** 8 cm   **D** 12 cm

21 Interference is the name given to the

A   bending of waves round an obstacle

B   splitting of white light into colours

C   addition of two coherent waves to produce a stationary wave pattern

D   change of direction when waves cross the boundary between one medium and another

22 A student sets up a demonstration of stationary wave by using stretched string of length 3.2 m. The speed of the waves is found to be 160 m s^{-1}. How many nodes and antinodes will be seen when he tunes the frequency to 100 Hz?

A   1 antinodes and 2 nodes

B   2 antinodes and 3 nodes

C   3 antinodes and 4 nodes

D   4 antinodes and 5 nodes

23 A wave of amplitude 5 cm has intensity 30 Wm^{-2}. What is the intensity of a second wave of amplitude 2.5 cm?

A 7.5 Wm^{-2} **B** 15 Wm^{-2} **C** 21 Wm^{-2} **D** 60 Wm^{-2}

24 If a wave can be polarised, it **must** be

A able to travel through vacuum.

B a progressive wave.

C a stationary transverse wave.

D a transverse wave.

**25** Visible light has wavelengths ranging from 400 nm to 700 nm, and its speed in a vacuum is 3.0×10^8 ms^{-1}. Calculate the smallest deviated angle from the direction of the incident beam in the first order when a parallel beam of white light is incident normally on a diffraction grating which has 4000 lines per cm.

A 6° **B** 9° **C** 13° **D** 16°

26 Which values of the separation of slits and distance of the screen from the slits in the Young's double slits experiment will produce the greatest separation of fringes? The same light source is used throughout the experiment.

	Separation of slits	Distance of the screen from the slits
A	1.0 mm	2 m
B	0.5 mm	2 m
C	1.0 mm	1 m
D	0.5 mm	1 m

27 The diagram shows the path of a charged particle with negligible mass, P during its passage between a pair of oppositely charged metal plates, X and Y. The plates are charged such that the electric field between them is directed from Y to X.
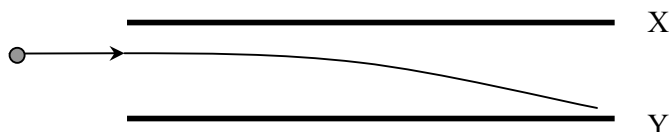

Which of the following is true?

A the particle P is positively charged.

B the resultant force that acted on particle P is to the left.

C the particle P is accelerating downwards during its passage between the plates.

**D** the resultant force acted on particle P is increasing during its passage between the plates.

28 A negative charge in a uniform electric field experience an electric force as shown. What is the direction of the electric field?

A downwards **B** upwards **C** to the left **D** to the right

29 Two large horizontal metal plates are separated by 6.0 mm. The lower plate is at potential of -8.0 V whereas the upper plate is at +8.0 V. What is the change in electric potential energy when a charged particle of 4 μC is moved from one end of the plate to another plate?

A 2.0 μJ **B** 32 μJ **C** 64 μJ **D** 107 μJ

30 It is found that a ceiling fan consumes 30 kJ of electrical energy after it is switched on for 10 minutes. What is the average current that flow through the fan?
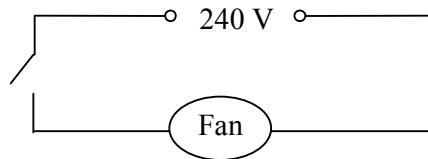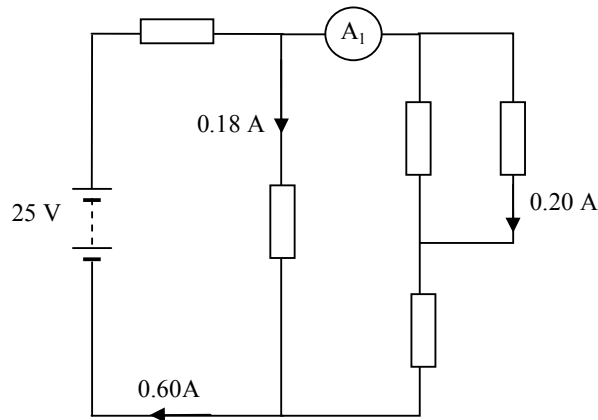

A 0.21 A **B** 0.80 A **C** 8.0 A **D** 12 A

31 The diagram shows a combination of four identical resistors, each of them is 10 Ω. What is the total resistance of the combination between X and Y?


A 2.5 Ω **B** 10 Ω **C** 25 Ω **D** 40 Ω
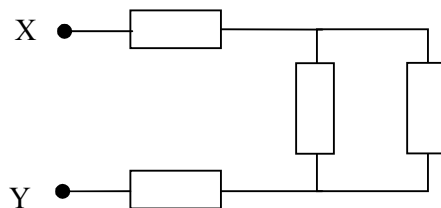
32 The diagram represents a circuit. Some currents have been shown on the diagram. What is the reading of ammeter A_1 ?

A 0.02 A   **B** 0.38 A   **C** 0.42 A   **D** 0.78 A

33 What is meant by the potential difference across a resistor?

A It is the energy converted into electrical energy when unit charge passes through the resistor.

B It is the amount of electrical energy converted into heat when unit charge passes through the resistor.

C It is the total amount of energy that converted to heat in the resistor.

D It is the rate of work done to move unit charge through the resistor.

**34** An α-particle, a β-particle and γ-ray enter a uniform electric field of strength E between plates S and T.

α-particle, a β-particle and γ-ray
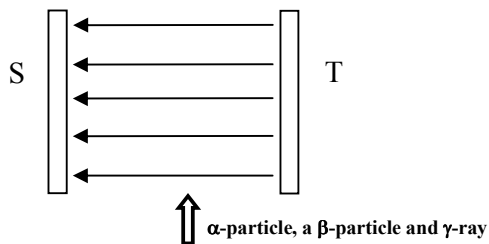
Which combination correctly describes their deflections inside the electric field?

	α-particle	β-particle	γ-ray
A	undeflected	towards S	undeflected
B	towards T	undeflected	towards S
C	towards S	towards T	undeflected
D	towards T	towards S	undeflected

35 The algebraic sum of e.m.f. of any closed loop in a circuit is equal to the algebraic sum of the p.d. Which of the following is correct?

  A This is Kirchhoff's first law, which results from the conservation of charge.

  B This is Kirchhoff's first law, which results from the conservation of energy.

  C This is Kirchhoff's second law, which results from the conservation of charge.

  D This is Kirchhoff's second law, which results from the conservation of energy.

36 In the potentiometer circuit shown below, balance has been obtained.
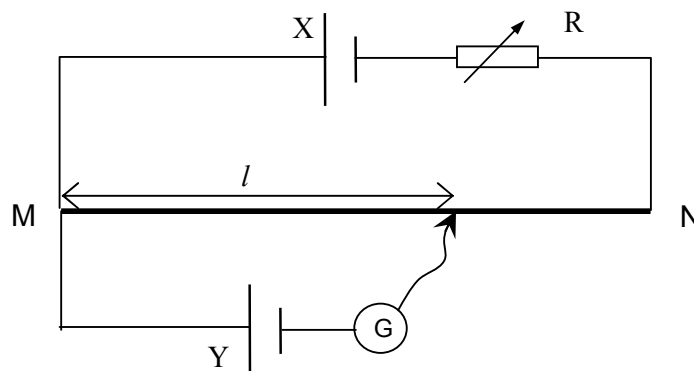
Which of following statement is true?

  A The current through the slide wire MN and the cell Y are equal.

  B The e.m.f. of cell X must be greater than cell Y.

  C A decrease in the resistance of R would require an increase in l to restore balance

  D If the length of wire MN is shortened, the length of l required to balance is remained unchanged.

37 A cell with internal resistance 2.0 Ω is connected in series with a 20 Ω resistor and a switch as shown in the figure below. A voltmeter connected across the cell reads 8.0 V when it is closed.
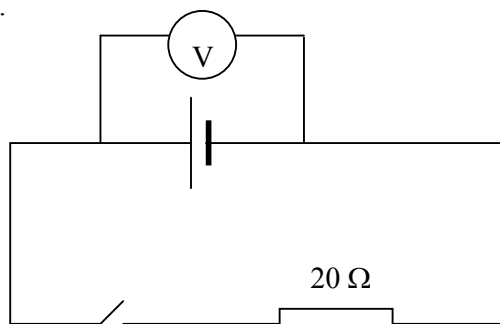
What is the e.m.f. of the cell?

  A 0.80 V   **B** 1.6 V   **C** 8.8 V   **D** 16 V

38 The nuclear model of the atom was revised by Rutherford to explain the α – scattering experiments. Which one of the following is true about his explanation?

A All the atom's positive and negative charge are concentrated in a relatively small volume.

B The volume of nucleus is about half of the volume of atom.

C α-particles are reflected due to momentum after collision with the nucleus.

D The electrons surround the nucleus at a relatively large distance.

39 An event on a distant star causes the emission of a burst of radiation containing β-particles, γ-rays and light.
Which one of the following statements about the order in which these radiations arrive at the Earth is correct?

A The light would arrive first.

B The light and the β-particles would arrive together, ahead the γ-rays

C The light and the γ-rays would arrive together, ahead the β-particles.

D All three would arrive together.

40 Thorium-232, $^{232}_{90}Th$ undergoes a series of decays until eventually a stable isotope is reached. The particles emitted in the successive transformations are

$$\alpha \quad \beta \quad \beta \quad \alpha \quad \alpha$$

Which nuclide is **not** produced during this series of transformations?

A $^{222}_{88}Ra$

B $^{224}_{88}Ra$

C $^{228}_{89}Ac$

D $^{228}_{90}Th$