PP-DSE
CS (PHY)

SECTION A

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER

COMBINED SCIENCE — PHYSICS

(1 hour 40 minutes)

This paper must be answered in English

GENERAL INSTRUCTIONS

1. There are **TWO** sections, A and B, in this Paper. You are advised to finish Section A in about 40 minutes.

2. Section A consists of multiple-choice questions in this question paper, while Section B contains conventional questions printed separately in Question-Answer Book **B**.

3. Answers to Section A should be marked on the Multiple-choice Answer Sheet while answers to Section B should be written in the spaces provided in Question-Answer Book **B**. **The Answer Sheet for Section A and the Question-Answer Book for Section B will be collected separately at the end of the examination.**

4. The diagrams in this paper are **NOT** necessarily drawn to scale.

5. The last pages of this question paper contain a list of data, formulae and relationships which you may find useful.

6. The question paper for Section A will be collected at the end of the examination.

INSTRUCTIONS FOR SECTION A (MULTIPLE-CHOICE QUESTIONS)

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.

2. When told to open this book, you should check that all the questions are there. Look for the words **'END OF SECTION A'** after the last question.

3. All questions carry equal marks.

4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

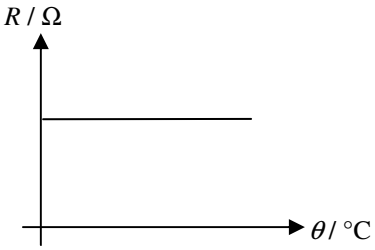
6. No marks will be deducted for wrong answers.

There are 24 questions.

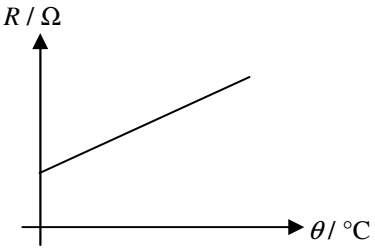
Section A

1. The graphs below show how the electrical resistances R of three different circuit elements change with temperature θ. Which of the circuit elements can be used to measure temperature ?

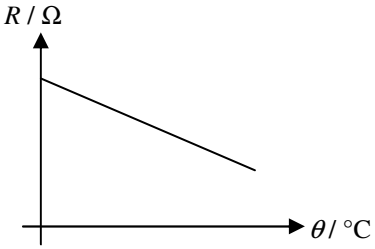
(1)



(2)

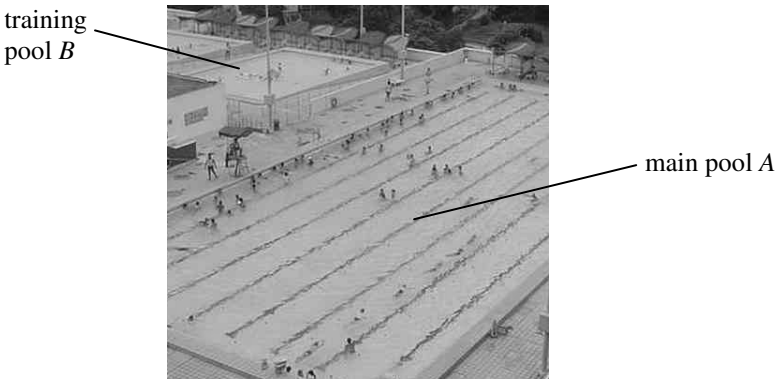


(3)



A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

2. In the figure below, a training pool B is located next to the main pool A. The training pool B has a smaller area and is shallower. If the pools are under the sunlight at the same time, which of the following statements about the rise in the water temperature of the two pools is correct ? Assume that the initial water temperatures of the pools are the same.



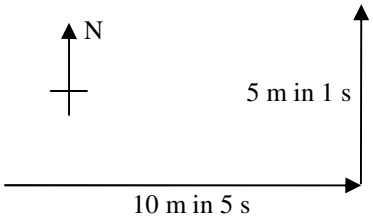
A. The water temperature of training pool B rises faster because it is shallower.
B. The water temperature of training pool B rises faster because it has a smaller surface area.
C. The water temperature of main pool A rises faster because it is deeper.
D. The water temperature of main pool A rises faster because it has a larger surface area.

3. Peter adds 50 g of milk at 20°C to 350 g of tea at 80°C, what is the final temperature of the mixt

Given : Specific heat capacity of milk = 3800 J kg^{-1} $°C^{-1}$
Specific heat capacity of tea = 4200 J kg^{-1} $°C^{-1}$

A. 50.0°C
B. 72.5°C
C. 73.1°C
D. 77.4°C

4.



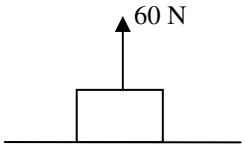
A toy car travelled due east for 10 m in 5 s, then immediately turned north and travelled 5 m for 1 s. What was the average speed of the car ?

A. 1.9 m s^{-1}
B. 2.2 m s^{-1}
C. 2.5 m s^{-1}
D. 3.5 m s^{-1}

5. A stone falls from rest. Neglecting air resistance, the ratio of the distance travelled by the stone in the 1st second to that travelled in the 2nd second is

A. 1 : 1
B. 1 : 2
C. 1 : 3
D. 1 : 4

6.



A block of weight 100 N is placed on a horizontal table and a vertical force of 60 N is exerted on the block as shown in the figure above. Which of the following statements is/are correct ?

(1) The weight of the block is balanced by the force exerted on the block by the table.
(2) The weight of the block and the force exerted on the table by the block are equal in magnitude.
(3) The force exerted on the table by the block and the force exerted on the block by the table are an action-reaction pair.

A. (1) only
B. (3) only
C. (1) and (2) only
D. (2) and (3) only

7.

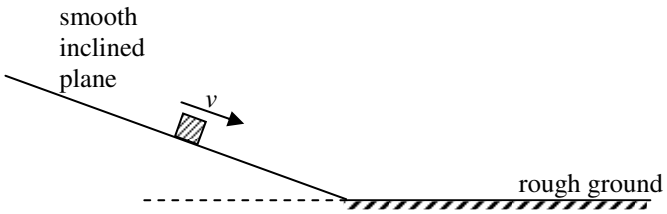


Figure (a)

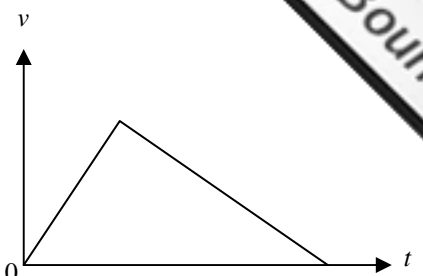
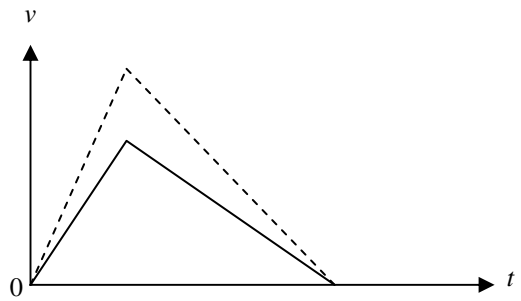


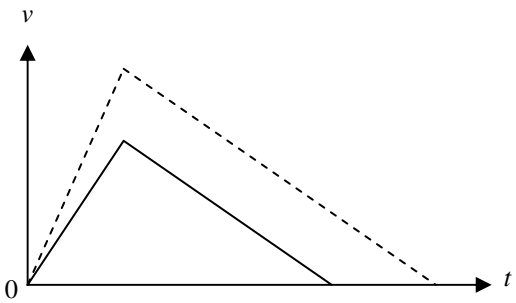
Figure (b)

As shown in Figure (a), a block slides down along a smooth inclined plane from rest. The corresponding speed-time graph of its motion is shown in Figure (b). Which of the following speed-time graphs (in dotted lines) best represents the motion of the block if it is released at a higher position on the plane instead ? Assume that the friction between the ground and the block remains unchanged.

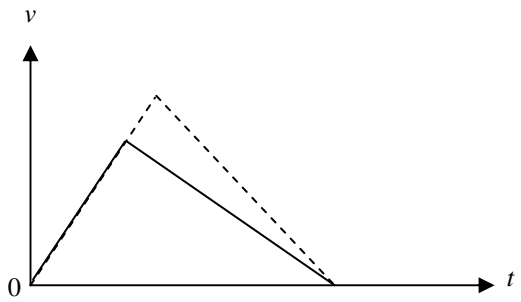
A.



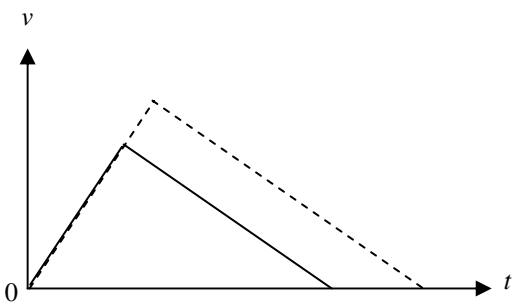
B.



C.



D.



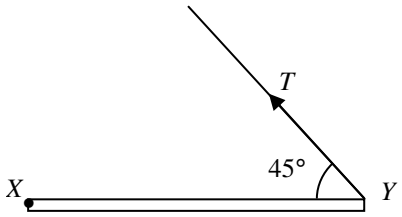
8.

A football player kicks a ball on the ground. The ball leaves the ground with speed v and hits the bar at X with a speed of 17 m s^{-1}. X is 2 m above the ground. Neglecting air resistance, what is the value of v ?

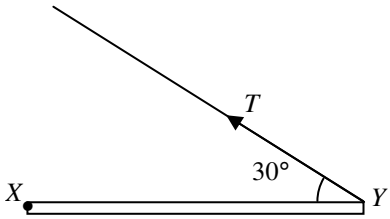
A. 15.8 m s^{-1}
B. 18.1 m s^{-1}
C. 19.0 m s^{-1}
D. 23.3 m s^{-1}

9. A rod XY hinged at X is kept horizontal by a light string. M is the midpoint of XY. In which of the following arrangements will the tension T in the string be the smallest ?

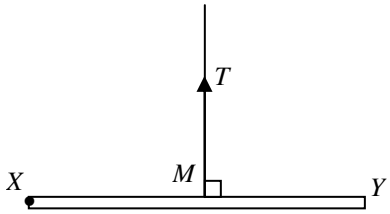
A.



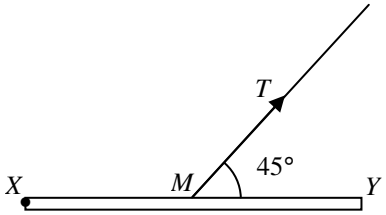
B.



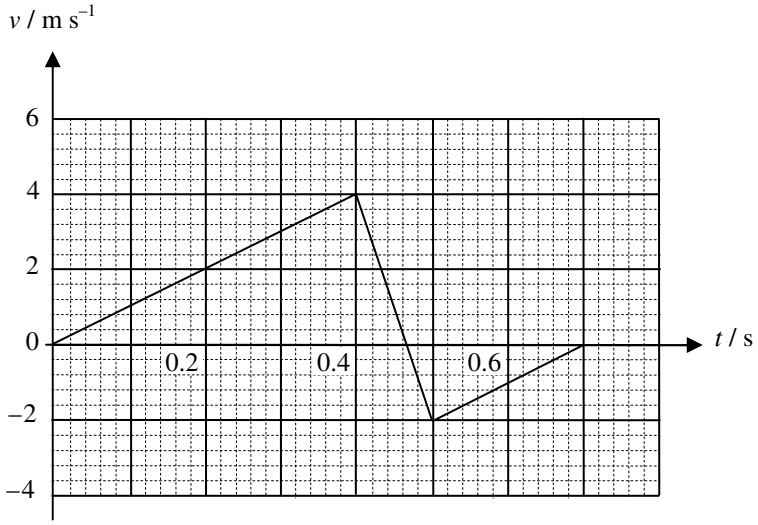
C.



D.



10.



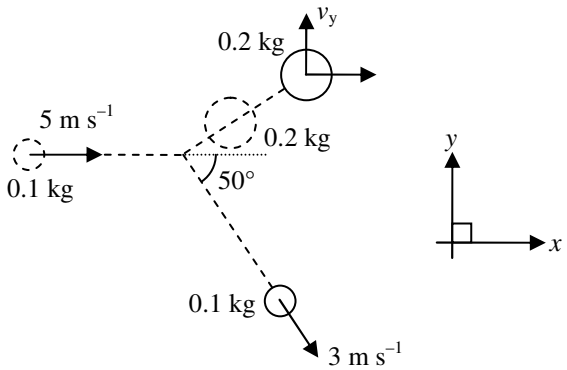
A ball of mass 0.2 kg is released from rest. It hits the ground and rebounds. The velocity-time graph of the ball is shown above. Which of the following statements are correct ?

(1) The magnitude of the change in momentum of the ball during the collision is 1.2 kg m s^{-1}.
(2) The magnitude of the average force acting on the ball by the ground during the collision is 12 N.
(3) There is mechanical energy loss during the collision.

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

Go on to the next page

11. A disc of mass 0.1 kg and velocity 5 m s^{-1} strikes a stationary disc of mass 0.2 kg on a smooth t
the collision, the 0.1 kg disc moves with a speed of 3 m s^{-1} at 50° to the x direction. Find the comp
the velocity of the 0.2 kg disc in y direction, v_y, after the collision.

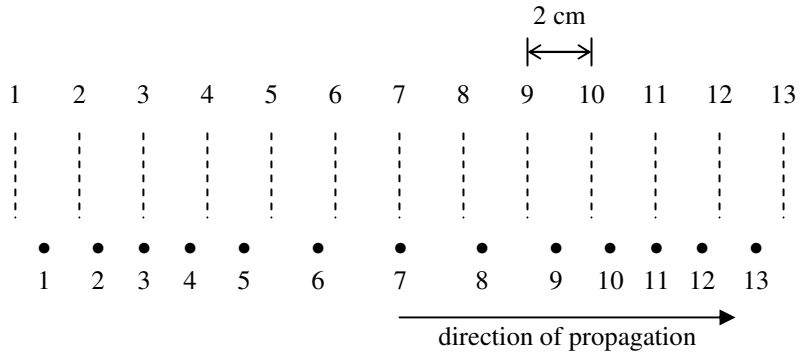


A. 1.15 m s^{-1}
B. 1.54 m s^{-1}
C. 1.92 m s^{-1}
D. 2.01 m s^{-1}

12. Which of the following phenomena demonstrates that light is an electromagnetic wave ?

A. Light carries energy.
B. Light reflects when it meets a polished metal surface.
C. Light bends when it travels across a boundary from one medium into another.
D. Light can travel from the Sun to the Earth.

13.

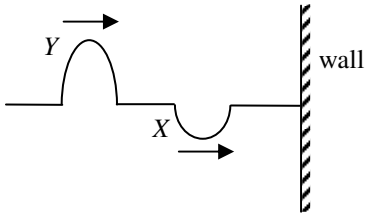


A longitudinal wave travels to the right through a medium containing a series of particles. The figure above shows the positions of the particles at a certain instant. The dotted lines indicate the equilibrium positions of the particles. Which of the following statements about the wave at the instant shown is/are correct ?

(1) The wavelength of the longitudinal wave is 16 cm.
(2) Particles 8 and 10 are moving in the same direction.
(3) Particle 3 is momentarily at rest.

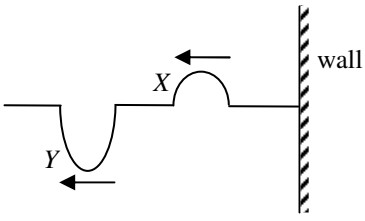
A. (1) only
B. (3) only
C. (1) and (2) only
D. (2) and (3) only

14.

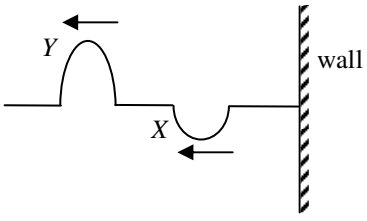


Two pulses, *X* and *Y*, are travelling along a string which is fixed at one end to the wall as shown in the figure above. Which of the following is a possible waveform of the string after the two pulses reflect ?

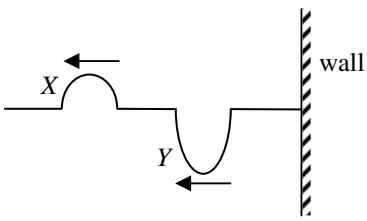
A.



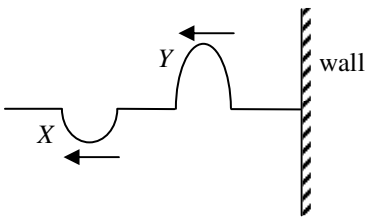
B.



C.



D.



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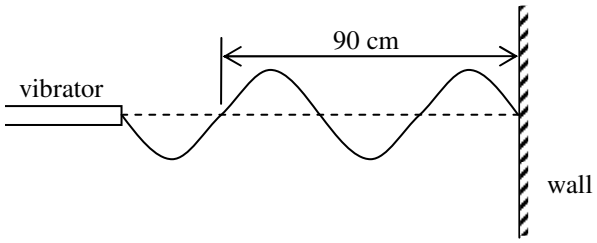
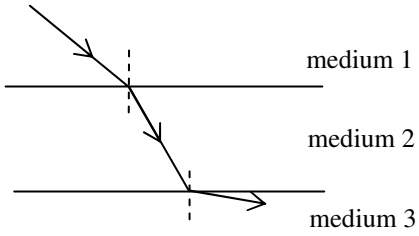
15.



A stationary wave is set up along a string by a vibrator. The waveform at a certain instant is shown above. If the frequency of the vibrator is 50 Hz, what is the wave speed along the string ?

A. 15 m s^{-1}
B. 30 m s^{-1}
C. 45 m s^{-1}
D. 55 m s^{-1}

16.



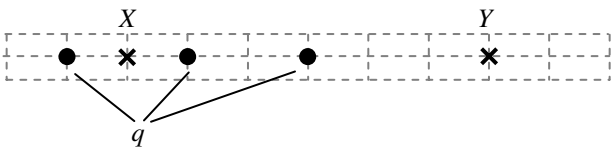
As shown above, a ray of light travels from medium 1 to medium 2, and then enters medium 3. The boundaries are parallel to each other. Arrange the speed of light, c, in the three media in **ascending** order.

A. $c_3 < c_2 < c_1$
B. $c_3 < c_1 < c_2$
C. $c_2 < c_3 < c_1$
D. $c_2 < c_1 < c_3$

17. In a Young's double slits experiment, some fringes are seen on a screen. Which of the following changes will increase the fringe separation ?

	Slits separation	**Distance between slits and screen**
A.	increase	increase
B.	increase	decrease
C.	decrease	increase
D.	decrease	decrease

18.



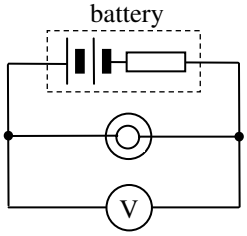
Three identical point charges q (represented by dots) are situated in the space as shown. Which of the following descriptions about the direction and magnitude of the electric field E at X and at Y is correct ?

	Direction	**Magnitude**
A.	Same	$E_X > E_Y$
B.	Same	$E_X < E_Y$
C.	Opposite	$E_X > E_Y$
D.	Opposite	$E_X < E_Y$

19. Two metal rods, X and Y, of uniform cross-sectional area are made of the same material and have the same volume. The length and resistance of X are l and R respectively. What is the resistance of Y if it has a length of $2l$?

A. $R/4$
B. $R/2$
C. $2R$
D. $4R$

20. The figure below shows a battery of e.m.f. 3.0 V and internal resistance 2.0 Ω is connected to a light bulb of resistance 10.0 Ω. A voltmeter of internal resistance 10 kΩ is connected in parallel with the light bulb. What is the reading of the voltmeter ?



A. 2.4 V
B. 2.5 V
C. 2.9 V
D. 3.0 V

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21. In Figure (a), two identical resistors are connected in series to a cell of e.m.f. V and negligible internal resistance. The power dissipated by each resistor is P. If the two resistors are now connected in parallel as shown in Figure (b), what is the power dissipated by each resistor ?

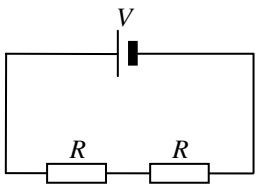


Figure (a)

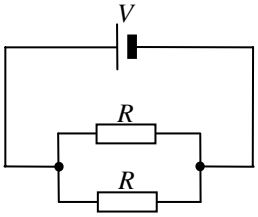
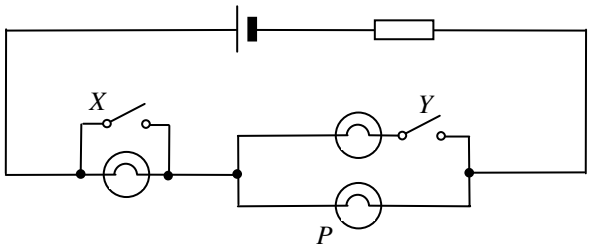


Figure (b)

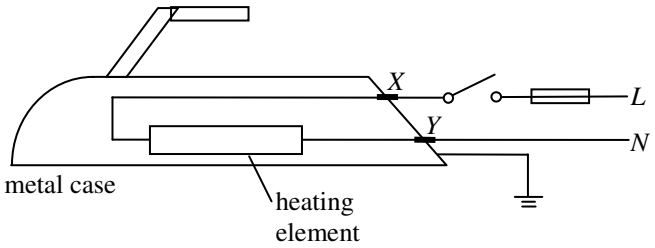
A. $2P$
B. $4P$
C. $8P$
D. $16P$

22. In the circuit below, three identical light bulbs are connected to a cell. Under what conditions will light bulb P have the maximum brightness ?



	Switch *X*	**Switch *Y***
A.	closed	open
B.	closed	closed
C.	open	open
D.	open	closed

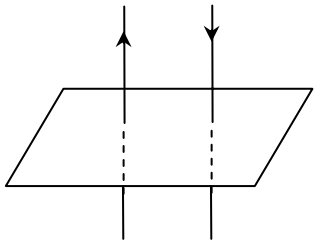
23.



The figure above shows the main parts of an electric iron. In which of the following situations will the fuse blow when the switch is closed ?

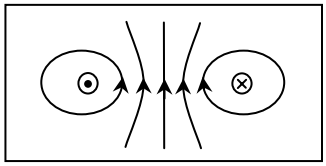
A. The heating element is broken and becomes an open circuit.
B. The earth wire is worn out and becomes disconnected.
C. The insulation at contact point X is worn out so that the wire touches the metal case.
D. The insulation at contact point Y is worn out so that the wire touches the metal case.

24.

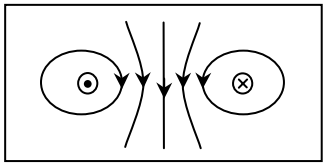


The figure above shows two parallel straight wires carrying equal currents in opposite directions. Which of the following diagrams correctly shows the resultant magnetic field lines ?

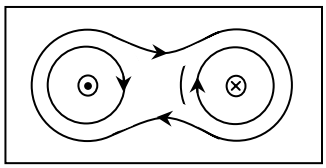
A.



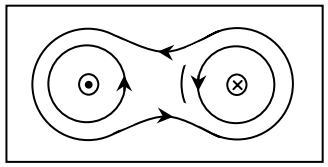
B.



C.



D.



END OF SECTION A

List of data, formulae and relationships

Data

acceleration due to gravity	$g = 9.81$ m s^{-2} (close to the Earth)
speed of light in vacuum	$c = 3.00 \times 10^8$ m s^{-1}
charge of electron	$e = 1.60 \times 10^{-19}$ C
electron rest mass	$m_e = 9.11 \times 10^{-31}$ kg
permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2}

Rectilinear motion

For uniformly accelerated motion :

$$\begin{aligned} v &= u + at \\ s &= ut + \frac{1}{2}at^2 \\ v^2 &= u^2 + 2as \end{aligned}$$

Mathematics

Equation of a straight line $y = mx + c$

Arc length = $r\theta$

Surface area of cylinder $= 2\pi rh + 2\pi r^2$

Volume of cylinder $= \pi r^2 h$

Surface area of sphere $= 4\pi r^2$

Volume of sphere $= \frac{4}{3}\pi r^3$

For small angles, $\sin\theta \approx \tan\theta \approx \theta$ (in radians)

$E = mc\,\Delta T$	energy transfer during heating and cooling	$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 r^2}$	Coulomb's law
$E = l\,\Delta m$	energy transfer during change of state	$E = \frac{Q}{4\pi\varepsilon_0 r^2}$	electric field strength due to a point charge
		$R = \frac{\rho l}{A}$	resistance and resistivity
$F = m\frac{\Delta v}{\Delta t} = \frac{\Delta p}{\Delta t}$	force	$R = R_1 + R_2$	resistors in series
moment = $F \times d$	moment of a force	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	resistors in parallel
$E_P = mgh$	gravitational potential energy	$P = IV = I^2 R$	power in a circuit
$E_K = \frac{1}{2}mv^2$	kinetic energy	$\frac{V_s}{V_p} \approx \frac{N_s}{N_p}$	ratio of secondary voltage to primary voltage in a transformer
$P = Fv = \frac{W}{t}$	mechanical power		

PP-DSE
CS (PHY)
SECTION B

B

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Candidate Number

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER
COMBINED SCIENCE — PHYSICS

SECTION B : Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5 and 7.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer **ALL** questions.

(4) Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) Graph paper and supplementary answer sheets will be provided on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(6) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

Answer **ALL** questions. Write your answers in the spaces provided.

1.

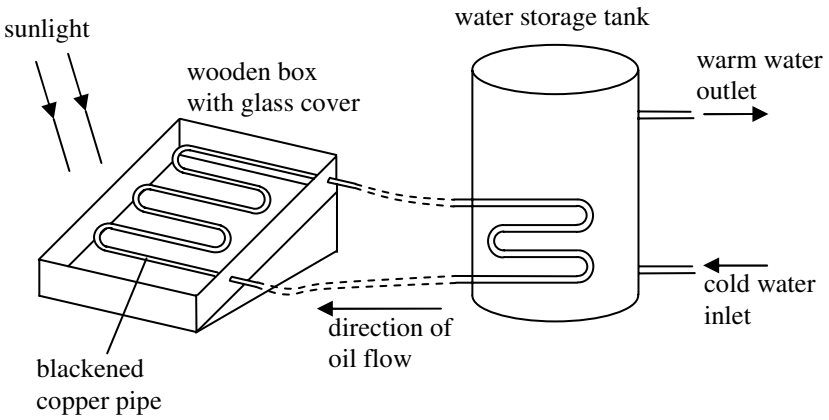

Figure 1.1

Figure 1.1 shows a solar water heating system. The heater is made from a glass-covered wooden box and the copper pipe inside is painted black. The heater is put on an inclined surface. Oil circulates between the heater and the water storage tank via the copper pipe.

(a) (i) Explain why the copper pipe inside the box is painted black.

(1 mark)

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(ii) Explain why the wooden box is covered by a sheet of glass.

(1 mark)

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Answers written in the margins will not be marked.

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(a) (iii) Explain why the oil circulates in the system in the direction as indicated in Figure 1.1.

(2 marks)

(b) When the oil flows through the pipe in the heater at a rate of 0.3 kg per minute, the temperature of the oil rises from 25°C to 37°C. Determine the power absorbed by the oil.

Given : specific heat capacity of oil = 2500 J kg^{-1} $°C^{-1}$

(3 marks)

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2.

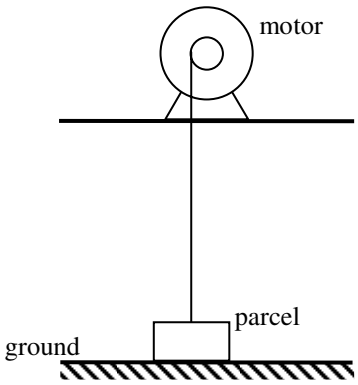

Figure 2.1

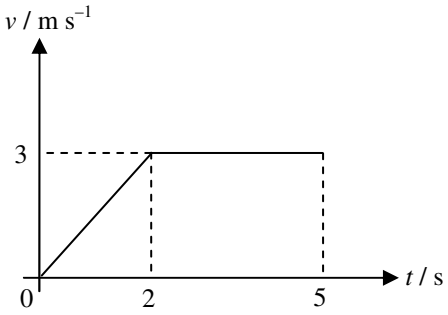

Figure 2.2

A parcel of mass 4 kg is being raised from the ground by a light string connected to a motor at the rooftop of a building as shown in Figure 2.1. The speed-time graph of the parcel for the first 5 s is shown in Figure 2.2. Neglect air resistance.

(a) Find the tension in the string at time t = 1 s.

(3 marks)

(b) Calculate the output power of the motor between t = 2 s and 5 s.

(2 marks)

(c) Suggest one reason why the input power to the motor is greater than the value found in (b).

(1 mark)

Answers written in the margins will not be marked.

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(d) At $t = 5$ s, the string suddenly breaks. Describe the subsequent motion of the parcel.

(2 marks)

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3. A smooth curved rail *PQR* is fixed on a horizontal bench as shown in Figure 3.1. *P* is at a height the bench surface. A small metal ball *X* of mass 0.03 kg is released from rest at *P*.

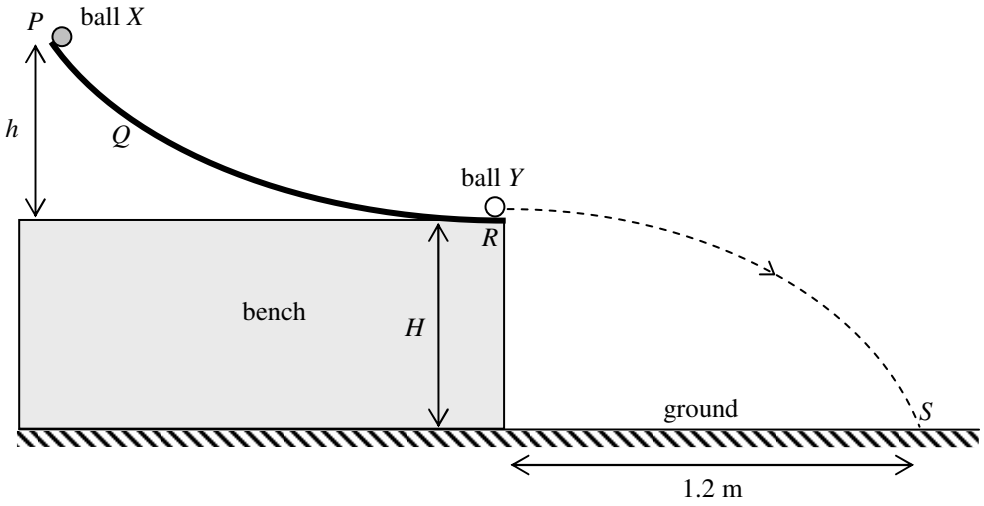

Figure 3.1

When ball *X* reaches *R*, it moves horizontally and collides head-on with another metal ball *Y* of mass 0.04 kg which is initially at rest on the rail. Immediately after the collision, ball *X* comes to rest while ball *Y* moves off the bench horizontally with a speed of 3 m s^{-1}. Neglect air resistance.

(a) What is the speed of ball *X* just before it collides with ball *Y* ?

(1 mark)

(b) Find the value of *h*.

(2 marks)

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Answers written in the margins will not be marked.

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(c) Ball *Y* lands on the ground at *S* which is at a horizontal distance of 1.2 m from the bench. Find the height *H* of the bench.

(3 marks)

(d) Ball *X* is now released at *Q* such that ball *Y* moves off the bench horizontally with a smaller speed after collision. Would the time of flight of *Y* change ? Explain briefly.

(2 marks)

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Answers written in the margins will not be marked.

4. Figure 4.1 shows three points, *P*, *Q* and *R*, in a ripple tank such that *PR* = 8 cm and *QR* = 10 dipper vibrating at 25 Hz is put at *P* to produce circular water waves of wavelength 0.8 cm.

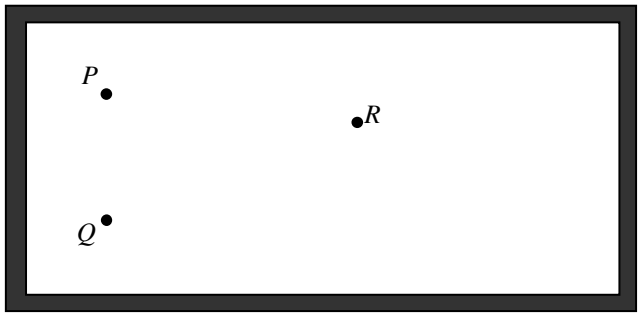

Figure 4.1

(a) Calculate the speed of the water waves in the ripple tank.

(2 marks)

(b) Another identical dipper, vibrating in phase with the one at *P*, is later put at *Q*. Explain the change, if any, in the amplitude of the water wave at *R*.

(3 marks)

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5. Figure 5.1 shows the following apparatus:

A low voltage power supply, a ray box with a single slit, a full circle protractor and a semi-circular gla block.

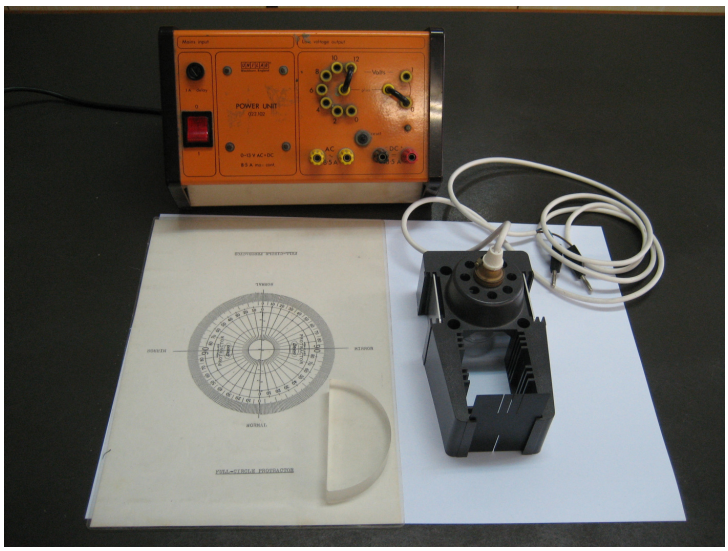

Figure 5.1

Describe how to use the above apparatus to measure the critical angle of the semi-circular glass block.

(5 marks)

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6. A drop of liquid is placed on a thin glass slide above a plastic ruler. The side view of the set-up i in Figure 6.1. Looking through the liquid drop, a magnified image of the number '9' on the ruler i as shown in Figure 6.2.

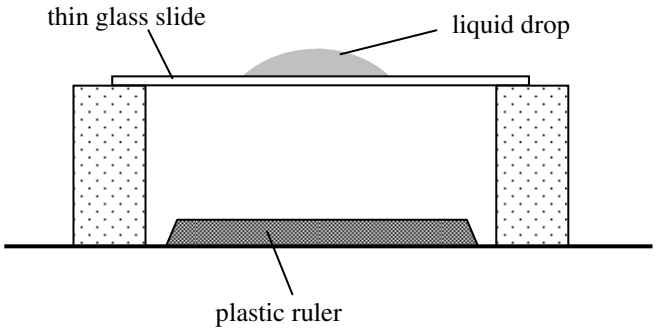


Figure 6.1

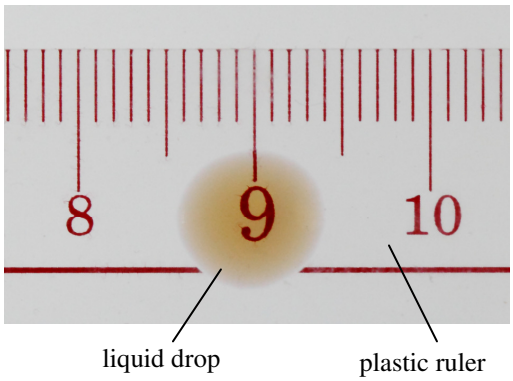


Figure 6.2

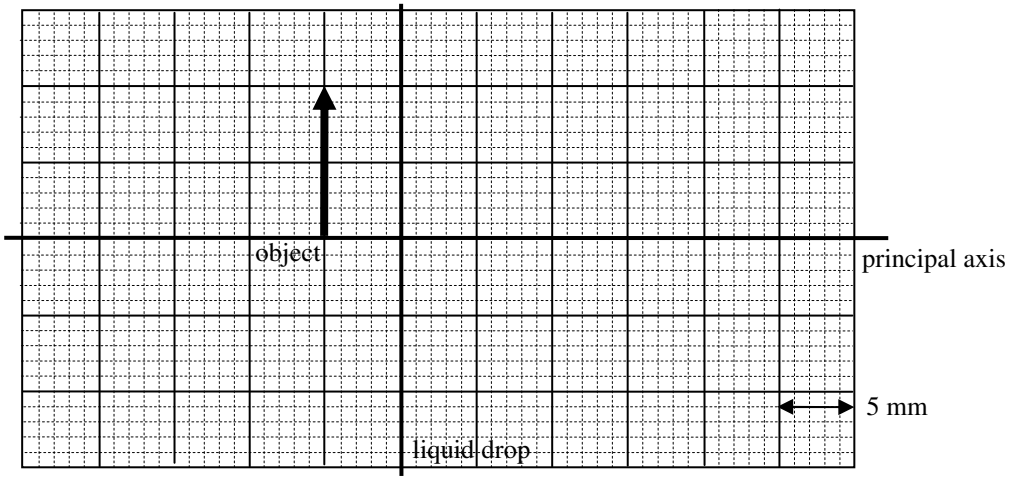
(a) The linear magnification of the number '9' is 1.4. Take the number '9' as the object, use the graph paper below to

(i) draw the image of the object, and

(ii) draw **one** light ray to find the focal length of the liquid drop.

You may neglect the effect due to the thin glass slide.

(3 marks)



Focal length of the liquid drop = _____ mm

(b) If the refractive index of the liquid becomes smaller, explain the change, if any, in the focal length of the liquid drop.

(2 marks)

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7.

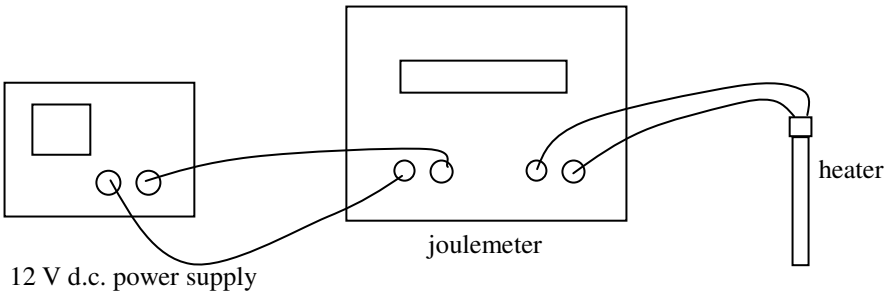

Figure 7.1

A 12 V heater is operated under a steady d.c. voltage of 12 V. The energy consumed by the heater is measured by a joulemeter as shown in Figure 7.1. In 120 s, the heater consumed 2400 J of energy.

(a) Estimate the electrical power of the heater.

(1 mark)

(b) Hence, find the current through the heater.

(2 marks)

(c) A 5 A fuse is installed in the power supply. Explain whether the fuse will blow if another identical heater is connected in parallel with the original heater.

(2 marks)

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8. As shown in Figure 8.1, two large vertical parallel metal plates, each in a slotted base, are plac
polystyrene tile. The plates are connected to the positive and negative terminals of an EHT su
respectively.

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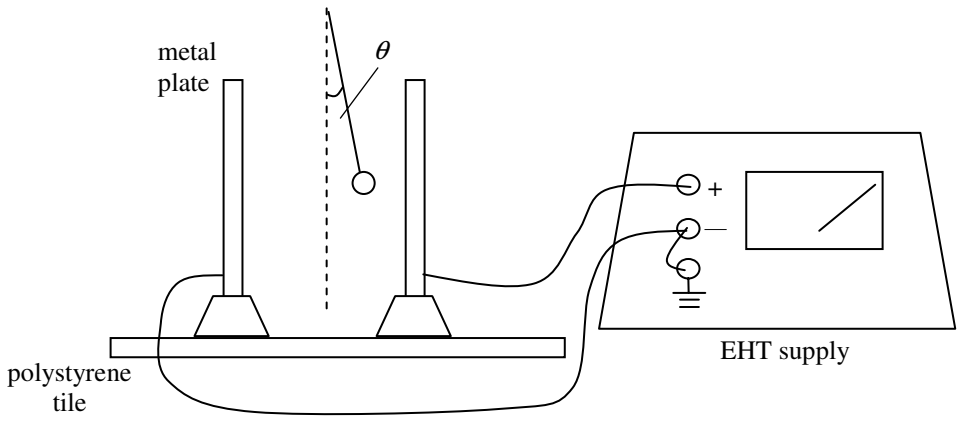

Figure 8.1

A small charged ball is suspended by a nylon thread and is placed midway between the plates. The thread makes an angle θ to the vertical when the ball is in equilibrium.

(a) Draw a free-body diagram to show the forces acting on the charged ball.

(2 marks)

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(b) (i) Express tan θ in terms of the electric force F acting on the ball and the weight W of the ball.

(1 mark)

(ii) Given that the mass of the ball is 0.07 g. When the electric field strength between the plates is 40000 N C^{-1}, $\theta = 2°$. Estimate the magnitude of the charge carried by the ball. Assume that the electric field between the plates is uniform.

(2 marks)

(c) Using the setup in Figure 8.1, suggest a simple method to test whether the electric field between the plates is uniform.

(3 marks)

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9. Read the following passage about ignition coils and answer the questions that follow.

Ignition coil

An ignition coil is used to produce sparks from the battery of a car to ignite the fuel in the engine. It is used to produce high-voltage pulses from a low-voltage d.c. supply.

An ignition coil consists of two coils of insulated copper wire that are wound around a common iron core. One coil, called the primary coil, is made from relatively few (tens or hundreds) turns of thick copper wire. The other coil, called the secondary coil, typically consists of many (thousands) turns of thin copper wire.

When an electric current is passed through the primary coil, a magnetic field is created. The iron core guides most of the primary coil's magnetic field to the secondary coil. When the current in the primary coil is suddenly interrupted, a high voltage pulse of many thousand volts is developed across the secondary coil. This voltage is often sufficient to cause an electrical discharge to produce a spark.

(a) Explain why a voltage is developed across the secondary coil when the current in the primary coil is suddenly interrupted.

(2 marks)

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(b) Suggest **one** reason why the voltage developed across the secondary coil is very large.

(1 mark)

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(c) Assume input power to the primary coil equals to the output power of the secondary coil, explain why thick wire should be used to construct the primary coil.

(2 marks)

END OF PAPER

Sources of materials used in this paper will be acknowledged in the *Hong Kong Diploma of Secondary Education Examination Practice Papers* published by the Hong Kong Examinations and Assessment Authority at a later stage.

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鳴謝
Acknowledgements

本專輯的試題曾引用下列刊物的資料：
Material from the following publications has been used in question papers in this volume:

Leisure and Cultural Services Department, The Government of HKSAR	http://www.lcsd.gov.hk/beach/b5/swim-address-s.php#paoyuekong

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