HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2017

PHYSICS PAPER 1

8.30 am – 11.00 am (2½ hours)

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 50 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 the Question-Answer Book. **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 two pages of the Question-Answer Book contain a list of data, formulae and relationships which you may find useful.

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 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.

> Not to be taken away before the
> end of the examination session

Section A

There are 33 questions. Questions marked with * involve knowledge of the extension component.

1. 30 g of milk at 10°C is added to 120 g of coffee at 80°C. Assuming there is no heat loss to the surroundings, what is the final temperature of the mixture ?
   Given: specific heat capacity of milk = 3800 J kg^{-1} °C^{-1}
   specific heat capacity of coffee = 4200 J kg^{-1} °C^{-1}

   A. 64.8°C
   B. 65.2°C
   C. 66.0°C
   D. 67.1°C

2. Same mass of solids P and Q are heated at the same rate. The temperature-time graphs of the two substances are shown below.
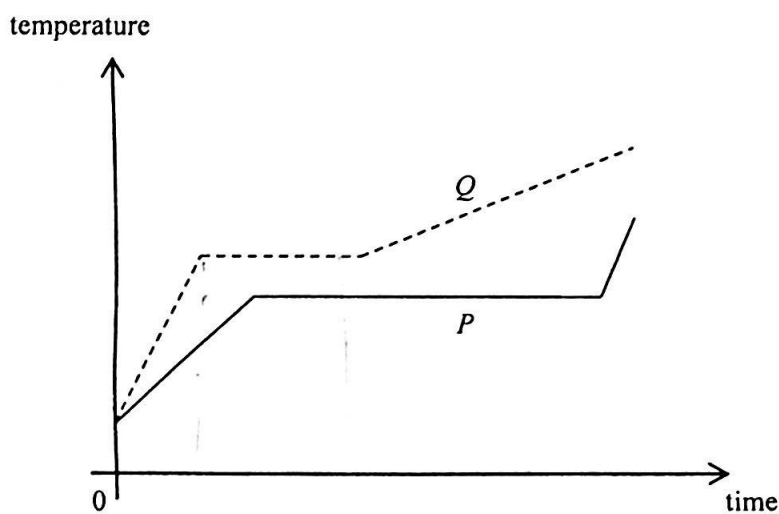
   Which of the following comparisons about their melting points and specific latent heats of fusion is correct ?

	higher melting point	larger specific latent heat of fusion
A.	P	P
B.	P	Q
C.	Q	P
D.	Q	Q

3. Which of the following statements about the internal energy of a substance are correct ?

   (1) When a solid melts, the latent heat of fusion absorbed becomes potential energy of the molecules in the substance.
   (2) When a vapour condenses, its internal energy decreases.
   (3) When a liquid evaporates, the internal energy of the remaining liquid increases.

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

*4. The pressure of a fixed mass of an ideal gas at 10°C is 2×10^5 N m^{-2}. If the volume of the gas is reduced to half of its original volume and its temperature is increased to 100°C, what would the pressure be ?

   A. 1.00×10^5 N m^{-2}
   B. 1.32×10^5 N m^{-2}
   C. 4.00×10^5 N m^{-2}
   D. 5.27×10^5 N m^{-2}

5. Which of the following statements about the motion of any two objects is correct ?

   A. The object that takes a shorter time to complete the same path must have greater average speed.
   B. The object that travels a greater distance in 1 s must have greater average velocity.
   C. The object with greater velocity must have greater acceleration.
   D. If the two objects have the same acceleration, they must be moving in the same direction.

6. A block is released from rest on an inclined plane as shown. The inclined plane makes an angle of 30° to the horizontal. The block moves with uniform acceleration, and travels a distance of 1 m in the first 3 s. Determine the acceleration of the block.
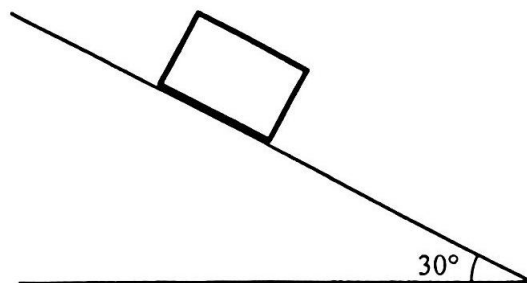

   A. 0.22 m s^{-2}
   B. 0.33 m s^{-2}
   C. 4.91 m s^{-2}
   D. Cannot be determined as the frictional force acting on the block is unknown.

7.　A block of mass m stays at rest on a rough inclined plane as shown.
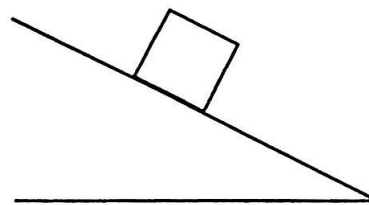
Which of the following diagrams correctly shows the forces acting on the block ?
(N is the normal reaction from the inclined plane, and f is the frictional force between the block and the plane.)

A.

N

f

mg

B.

f

N

mg

C.

N

f

mg

D.

f

N

mg
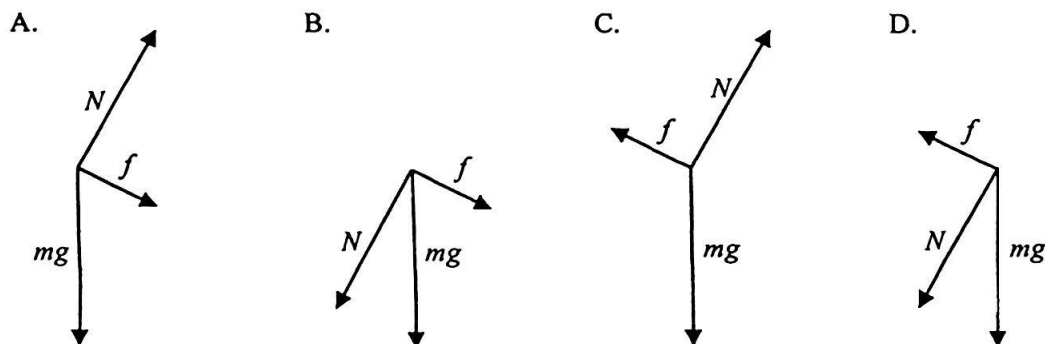
8.　Selfie sticks are popular nowadays. A uniform selfie stick of length 0.7 m is held horizontally as shown. Assume that the forces required to hold the selfie stick by the hand are represented by F_1 and F_2, and F_1 and F_2 are perpendicular to the stick.

0.1 m

mobile phone

F_1

2.0 N

F_2

1.5 N

0.7 m
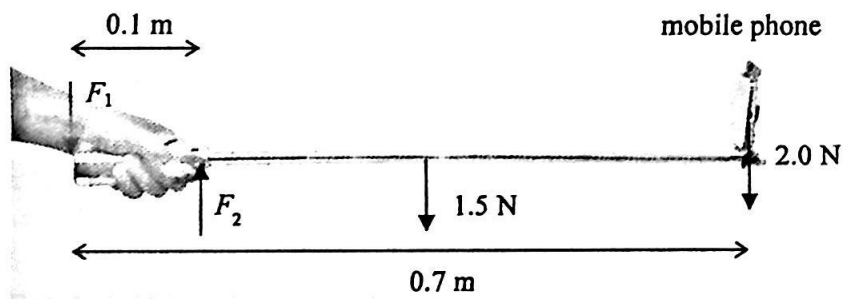
It is given that the weight of the selfie stick and the mobile phone are 1.5 N and 2.0 N respectively. Taking the mobile phone as a point mass, estimate the magnitude of F_2.

A.　3.5 N
B.　19.3 N
C.　35 N
D.　Cannot be determined as F_1 is unknown.

*9.   Marbles P and Q of the same mass are shot horizontally. They hit the horizontal ground at points R and S respectively as shown. Neglect air resistance.
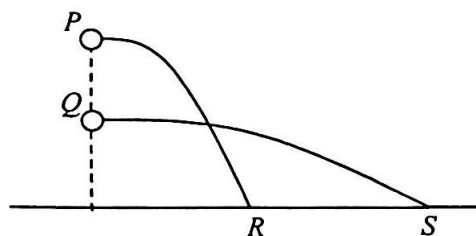
Which of the following statements is **INCORRECT** ?

    A.   The initial speed of marble P is smaller than that of marble Q.
    B.   The time of flight of marble P is shorter than that of marble Q.
    C.   The potential energy loss of marble P is greater than that of marble Q.
    D.   The acceleration of marbles P and Q is the same during the flight.

10.   Blocks X and Y are connected by a light inextensible string passing over a fixed frictionless light pulley as shown. The mass of X and Y are 0.5 kg and 1 kg respectively. Initially, Y is 1 m above the ground and the string is taut. The system is then released from rest.
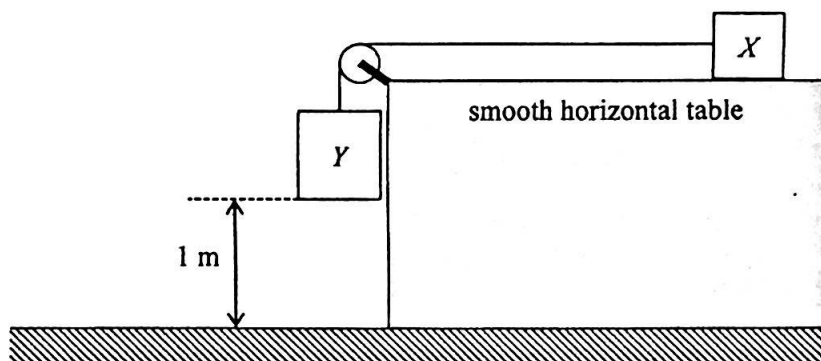

What is the speed of Y just before it reaches the ground ? (Take $g = 9.81$ m s^{-2})

    A.   3.62 m s^{-1}
    B.   4.43 m s^{-1}
    C.   6.26 m s^{-1}
    D.   9.81 m s^{-1}

11. A machine is fixed at the top of a smooth inclined plane. Two methods, (I) and (II), are used to lift a block from the ground to the top of the inclined plane by the machine.

(I)   Pull the block vertically upward at a uniform speed v.
(II) Pull the block up along the inclined plane at the same uniform speed v.
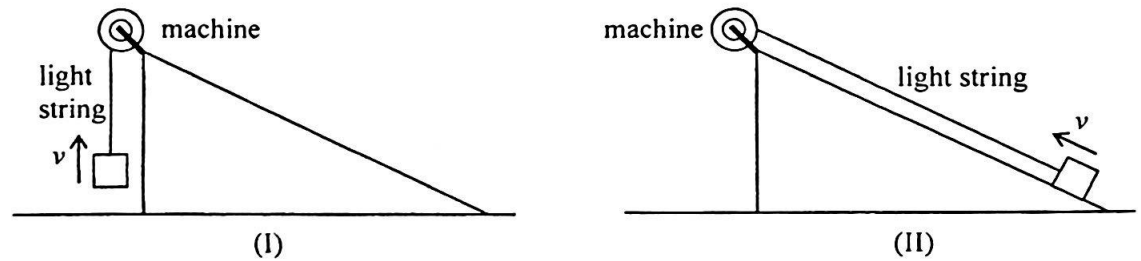
Which of the following statements correctly compare(s) the two methods ?

(1)   The tension in the string is the same.
(2)   The average output power of the machine is the same.
(3)   The work done by the machine on the block is the same.

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

12. Players of "bubble soccer" wear air-filled plastic "bubbles" as shown.
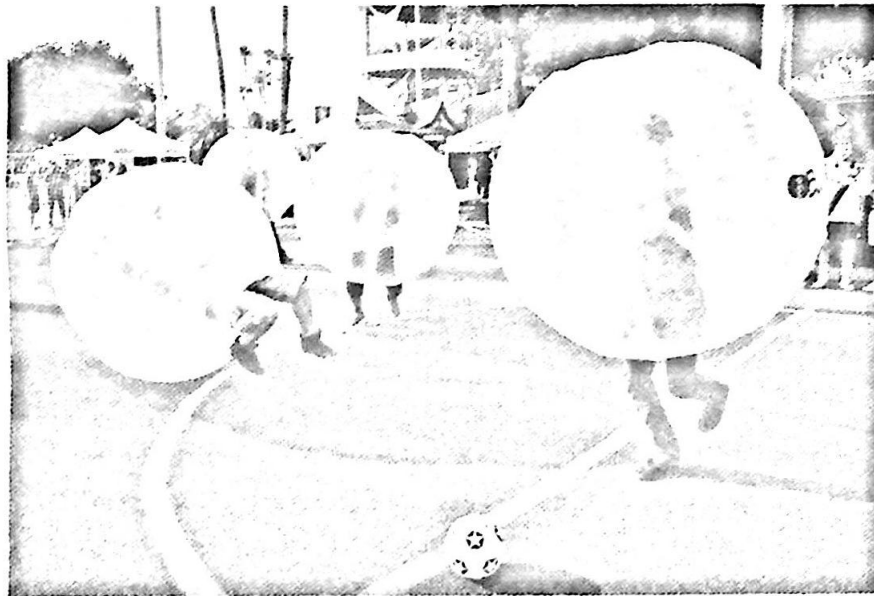
Which of the following statements best explains why the bubble can reduce the chance of injury during a collision ?

A.   The bubble increases the mass of the player, thus the momentum of the player increases.
B.   The bubble increases the air resistance acting on the player.
C.   The bubble lengthens the impact time during a collision.
D.   Like a balloon, the bubble provides a lifting force to the player.

*13. A small object is released from rest at a point very far away from a planet X. The object then starts moving towards X. X does not have an atmosphere. Neglect the effect of other celestial bodies.

Diagram **NOT** drawn to scale
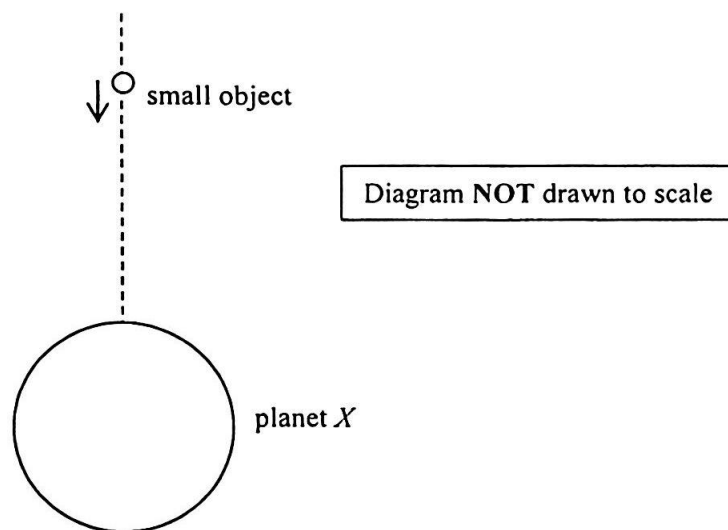
Which of the following graphs best shows the variation of the velocity v of the object with time t before it hits X?

A.

B.

C.

D.

10
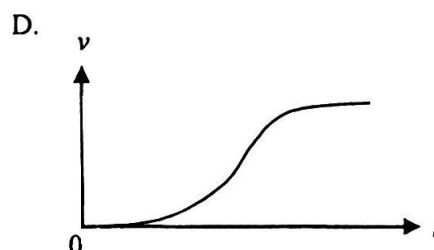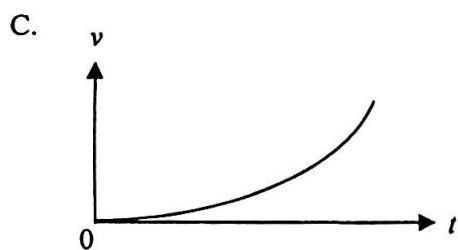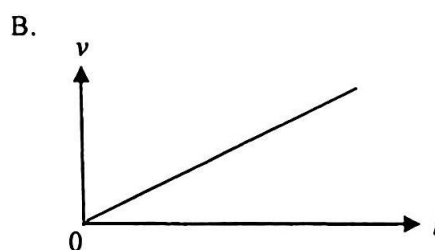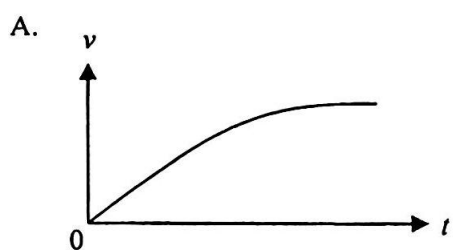
14. Figure (a) shows the equilibrium positions of particles E to N in a medium. At time $t = 0$, a longitudinal wave starts travelling from left to right. At time $t = 1$ s, the positions of the particles are shown in Figure (b).

Figure (a)   equilibrium positions

Figure (b)   time $t = 1$ s

direction of travel
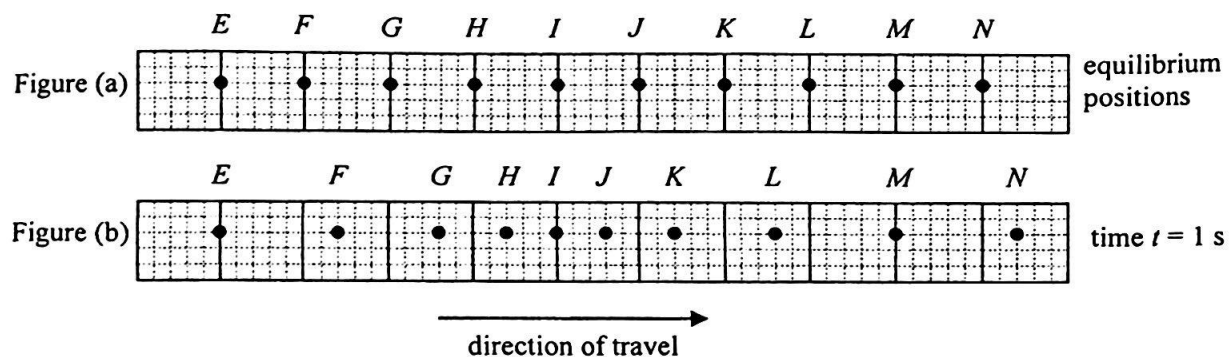
Which of the following statements MUST BE correct ?

A. The distance between particles F and N is equal to the wavelength of the wave.
B. The period of the wave is 1 s.
C. Particle E is always at rest.
D. Particle I is momentarily at rest at $t = 1$ s.

15. An experiment is set up to measure the speed of sound in air as shown. P and Q are two microphones connected to a timer. A sound is produced at X. The timer starts when P receives the sound, and stops when Q receives the sound. The timer shows the time taken for the sound to travel from P to Q. The distance PQ and the time shown can be used to calculate the speed of sound.


timer

X

P Q
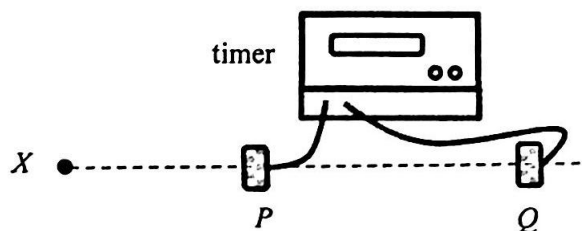
Which of the following statements is INCORRECT ?

A. X, P and Q must be along the same straight line.
B. The percentage error in the time measured will increase if the distance PQ is reduced.
C. The speed of sound determined should be independent of the distance between X and P.
D. The distance PQ must be equal to an integral multiple of wavelengths of the sound produced at X.

16. The figure shows plane water waves travelling from region X to region Y. The wavelengths of the water waves in regions X and Y are 4 cm and 5 cm respectively.
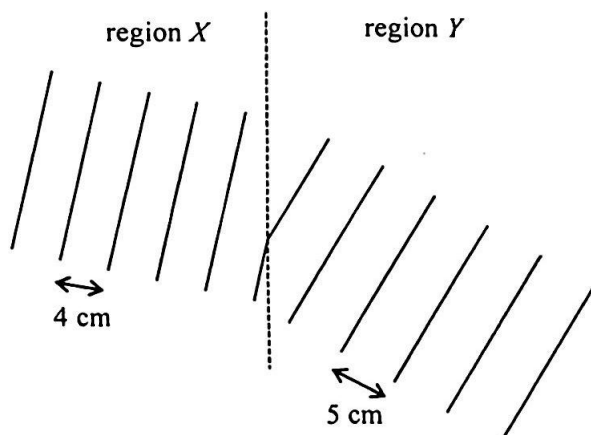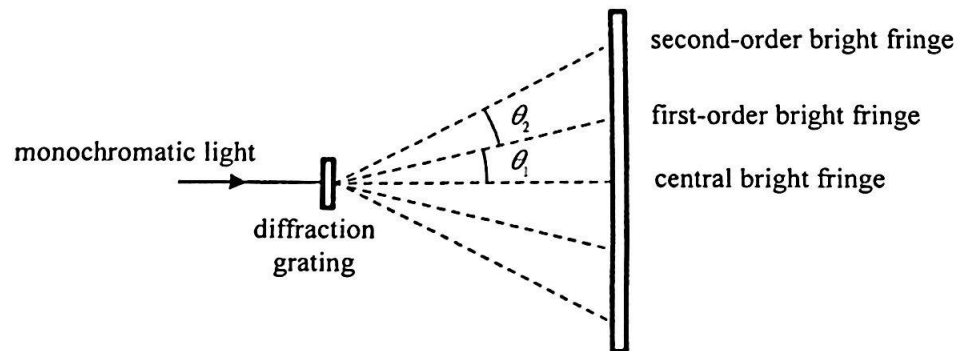

Which of the following statements is correct ?

A. The speed of the water waves in region X is higher than that in region Y.
B. The direction of travel of the water waves bends towards the normal as they enter region Y.
C. The frequency of the water waves is the same in both regions.
D. If plane water waves of wavelength 5 cm travel from region Y to region X, the wavelength becomes 6 cm after the waves enter region X.

17. In which of the following situations MUST the direction of travel of a wave change ?

(1) when a wave is reflected by a barrier
(2) when a wave enters from one medium to another medium
(3) when a wave travels through a gap smaller than its wavelength

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

18. Two musical notes of the same pitch and loudness are produced by two different musical instruments. They sound different to the human ears because they have different

A. amplitudes.
B. phases.
C. wave speeds.
D. waveforms.

*19. When an object is placed 30 cm in front of a concave lens, an image is formed 20 cm away from the lens. If the concave lens is replaced by a convex lens of the same focal length and the object distance remains unchanged, which of the following descriptions about the image formed is correct ?

	nature of the image	image distance
A.	real	20 cm
B.	real	60 cm
C.	virtual	20 cm
D.	virtual	60 cm

*20. The figure below shows some of the bright fringes formed when monochromatic light passes through a diffraction grating.

Which of the following is/are correct ?

(1) $\theta_1 = \theta_2$
(2)   The maximum order of bright fringe is 4 if $\theta_1 = 20°$.
(3) θ_1 will decrease if the experiment is performed in water but not in air.

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

21. If the speed of sound in water is x and the speed of light in water is y, which of the following is correct ?

	speed of sound in air	speed of light in air
A.	$> x$	$> y$
B.	$> x$	$< y$
C.	$< x$	$> y$
D.	$< x$	$< y$

22. In the figure, two charged conducting spheres of the same mass m are put in a vertical plastic cylinder. The inner wall of the cylinder is smooth. The spheres are separated by a distance d and remain in equilibrium.
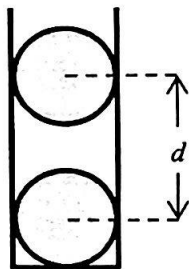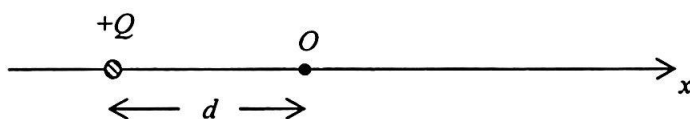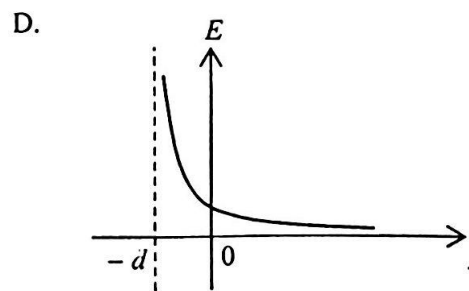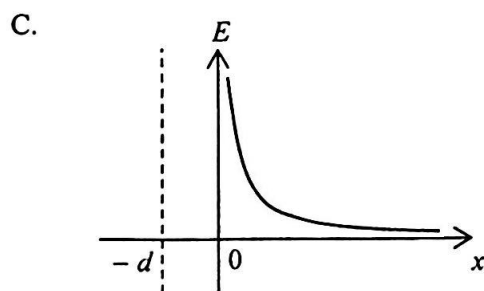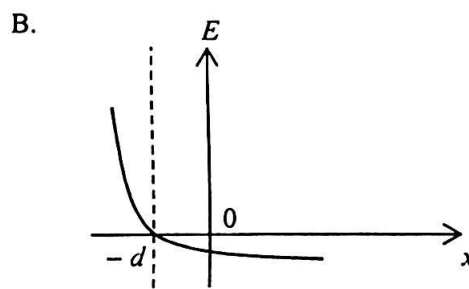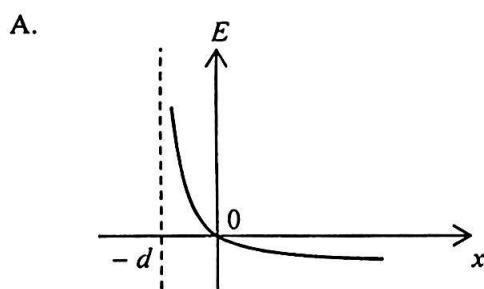

Which of the following statements MUST BE correct ?

(1) Both spheres carry positive charges.
(2) The amount of charges on the two spheres is the same.
(3) The separation d depends on m.

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

*23. A point charge $+Q$ is fixed at a distance d away from the origin O as shown.

Which of the following graphs best represents the variation of the electric field strength E along the x-axis ? (Take the electric field pointing to the right as positive.)

A.

B.

C.

D.

24. In the circuit, all resistors are identical. The internal resistance of the battery can be neglected.
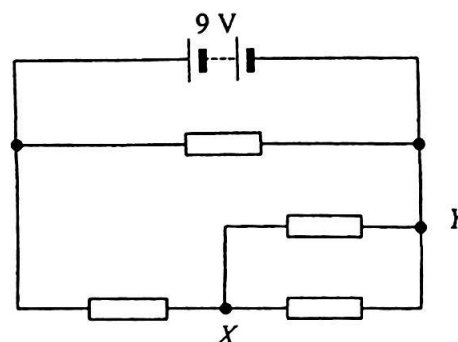

What is the potential difference between X and Y?

A. 1.5 V
B. 3.0 V
C. 4.5 V
D. 6.0 V

25. Which of the following statements about the use of a fuse is correct?

A. A fuse should be installed in the neutral wire.
B. A fuse is not required in an electrical appliance with double insulation.
C. A 5A fuse is suitable for a heater of rating '220 V, 1500 W'.
D. The melting point of a fuse should be lower than that of copper.

26. The figure shows a simple d.c. motor, the coil $ABCD$ is mounted between the poles of two slab-shaped magnets.
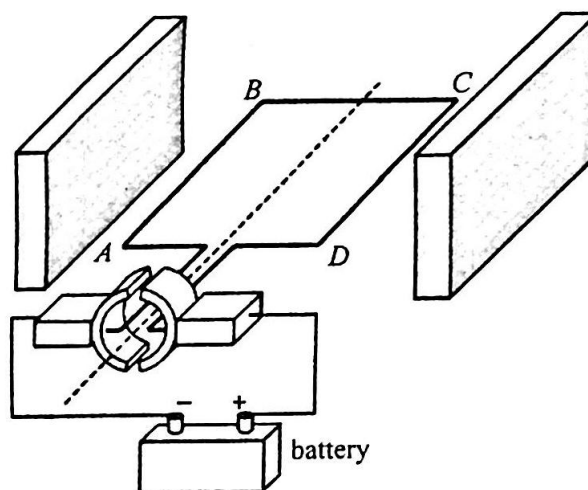
Which of the following statements is correct?

A. The turning effect is zero when the coil is vertical.
B. The magnetic force acting on BC is the greatest when the coil is horizontal.
C. The direction of the magnetic force acting on AB remains constant.
D. The direction of the current in the coil remains unchanged.

27. A metal disc is rotating about its centre C with constant speed. Part of the metal disc is inside a uniform magnetic field pointing into the paper as shown. An eddy current flows in the metal disc.
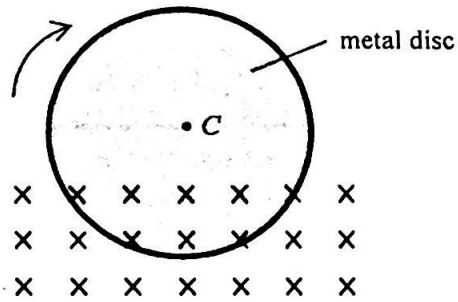
metal disc

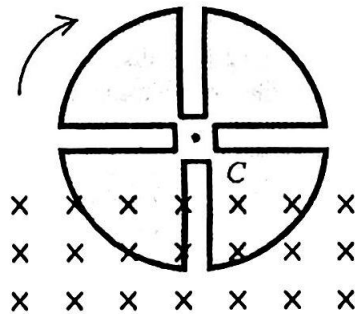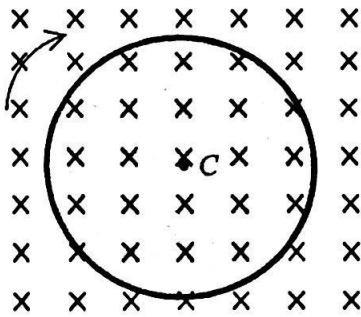After which of the following changes will the eddy current increase ?

A. Reverse the direction of the magnetic field


B. Increase the strength of the magnetic field
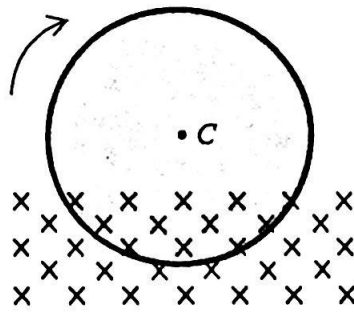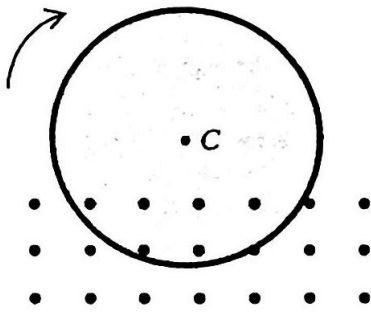
C. Apply the magnetic field over the whole metal disc


D. Cut several slits from the metal disc

*28. A metal rod PQ of length l is moving along smooth horizontal metal rails X and Y with constant speed v in a uniform magnetic field of magnetic field strength B pointing into the paper. The metal rails X and Y are separated by a distance of d and are connected to a resistor of resistance R as shown.
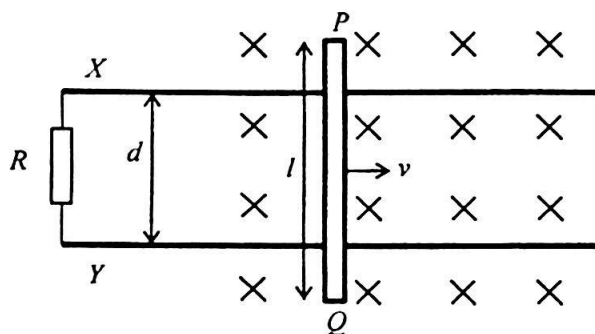
Which of the following descriptions about the induced current is correct ?

	magnitude	direction
A.	$\dfrac{Blv}{R}$	from X to Y through R
B.	$\dfrac{Blv}{R}$	from Y to X through R
C.	$\dfrac{Bdv}{R}$	from X to Y through R
D.	$\dfrac{Bdv}{R}$	from Y to X through R

*29. A heater of resistance 100 Ω is connected to the mains supply. The r.m.s. voltage of the mains supply is 110 V. Which of the following statements are correct ?

(1) The peak voltage across the heater is 156 V.
(2) The power dissipated by the heater is 121 W.
(3) The power dissipated by the heater will be doubled if the r.m.s. voltage of the mains supply doubles.

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

*30. The input terminal of a transformer is connected to the 220 V mains supply. Ten identical light bulbs are connected in parallel to the output terminal of the transformer. All the light bulbs are working at their rated values of '3 V, 1.5 W'. If the efficiency of the transformer is 70%, what is the current drawn from the mains supply ?

A. 0.007 A
B. 0.048 A
C. 0.068 A
D. 0.097 A

31. Which of the following diagrams best shows the deflection of α and β particles in a uniform electric field in vacuum ?

A.

B.

C.

D.
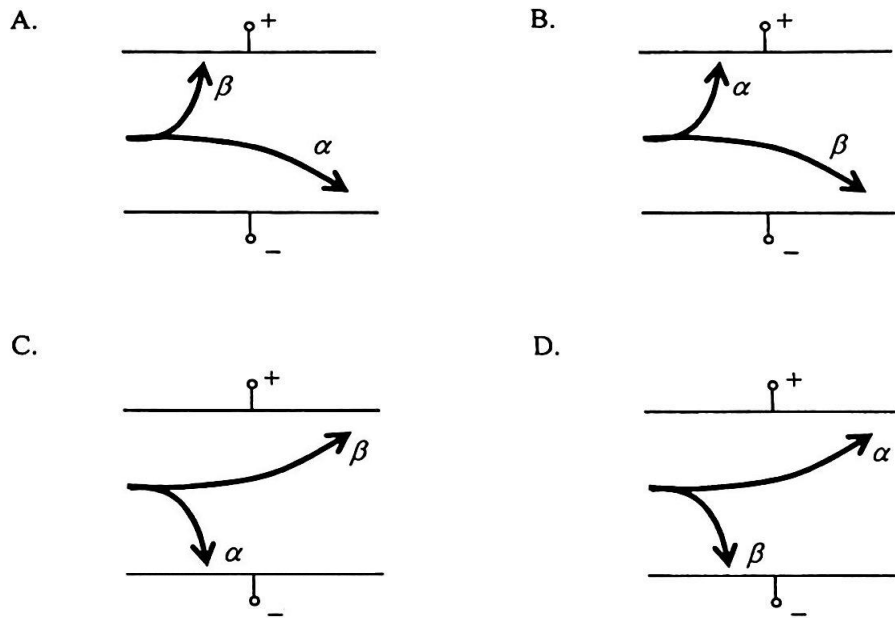
32. Which of the following statements about β particles and γ rays is correct ?

    A.   Only β particles can ionize air particles.
    B.   Only γ rays can travel through vacuum.
    C.   Both of them can be detected by a photographic film.
    D.   Both of them carry charge.

*33. The following shows the decay of uranium-238 ($^{238}_{92}U$).

$$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$$
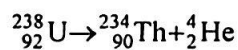
Given that :   mass of $^{238}_{92}U$ = 238.05079 u

                mass of $^{234}_{90}Th$ = 234.04363 u

                mass of $^{4}_{2}He$ = 4.00260 u

Which of the following statements is/are correct ?

(1)   The temperature required to start the decay is about 10^7 K.
(2)   The energy released in the decay of one uranium-238 nucleus is 4.25 MeV.
(3)   All the energy released in the decay becomes the kinetic energy of $^{4}_{2}He$.

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

END OF SECTION A