HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2018

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 this question paper 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.

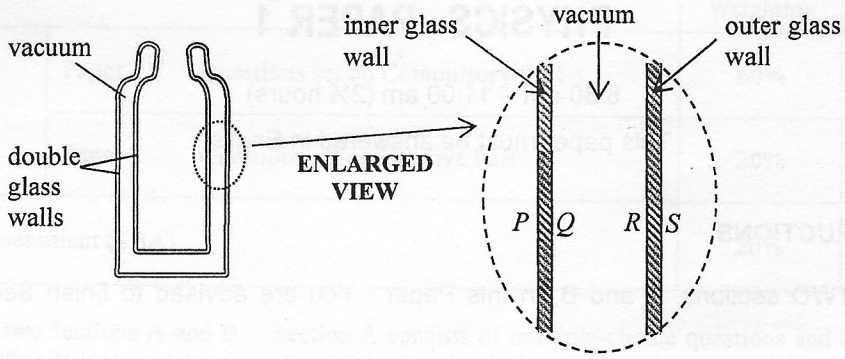
(6) No marks will be deducted for wrong answers.

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.

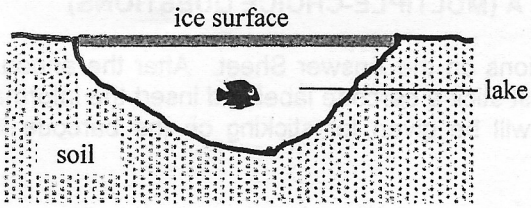
1.



The figure shows a vacuum flask with double glass walls for keeping liquids cold. *P*, *Q* and *R*, *S* are the glass surfaces of the inner and outer glass walls respectively. Which two surfaces are usually coated with silver ?

A. *P* and *R*
B. *Q* and *R*
C. *P* and *S*
D. *R* and *S*

2. In some countries, the outdoor temperature can drop below 0 °C in winter such that the lake surface becomes a thick layer of ice. However the water beneath the ice surface does not easily turn into ice and most aquatic life can survive during winter time.



Which statement below best explains this phenomenon ?

A. The layer of ice provides good heat insulation.
B. The freezing point of water below the ice surface is much lower than 0 °C.
C. There is thermal energy transferred from the soil to the water in the lake.
D. Ice releases latent heat when it melts.

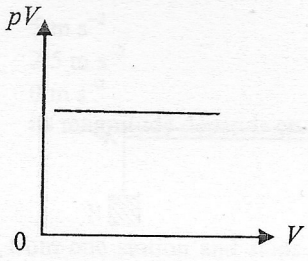
3. Milk at 5 °C is added to a cup of tea at 25 °C. Which statements below are correct ? Neglect the heat capacity of the cup and assume that there is no heat exchange with the surroundings.

(1) The average kinetic energy of the water molecules in the tea decreases.
(2) The average potential energy of the water molecules in the tea remains unchanged.
(3) The energy lost by the tea equals the energy gained by the milk.

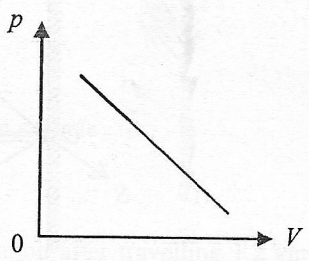
A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

*4. From which graph below can one deduce that the pressure p of a fixed mass of an ideal gas is inversely proportional to its volume V when the temperature of the gas is kept constant ?

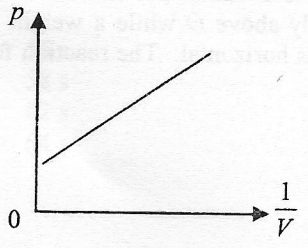
A.



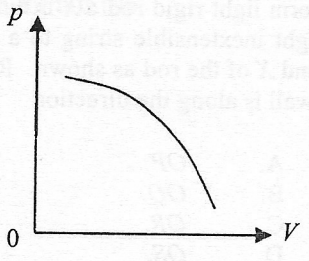
B.



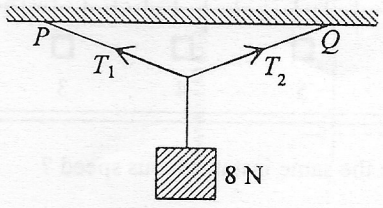
C.



D.



5. A block of weight 8 N is suspended from a horizontal ceiling by light inextensible strings to two different points P and Q as shown. The strings are equal in length.

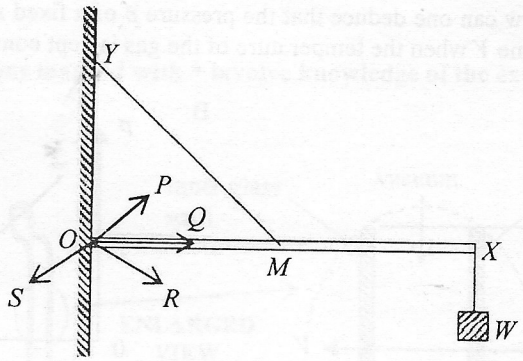


Which of the following descriptions about the tensions T_1 and T_2 in the two strings is/are correct ?

(1) The magnitude of T_1 must be greater than 4 N.
(2) The maximum value of T_2 would not exceed 8 N.
(3) The resultant force of T_1 and T_2 is zero.

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

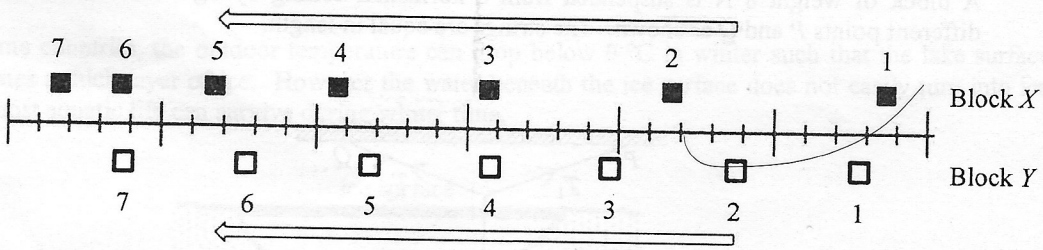
6.



A uniform light rigid rod OX is hinged smoothly to a wall at one end O. Its mid-point M is connected by a light inextensible string to a point Y directly above O while a weight W is suspended from the other end X of the rod as shown. Rod OX remains horizontal. The reaction force acting on the rod due to the wall is along the direction

A. OP.
B. OQ.
C. OR.
D. OS.

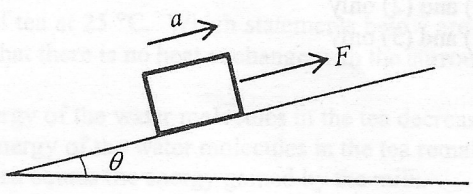
7. Two blocks X and Y are moving towards the left. Their positions at successive instants (indicated by the numbers) of equal time intervals are shown below.



Do these two blocks ever have the same instantaneous speed ?

A. Yes, at instant 3.
B. Yes, at a moment between instants 4 and 5.
C. Yes, at instant 6.
D. No.

8. A block of mass m is placed on a smooth incline making an angle θ with the horizontal as shown. When a force of magnitude F parallel to the incline is applied to the block, it travels up the incline with an acceleration a. If the applied force becomes $2F$, what would the magnitude of the acceleration be ?



A. greater than $2a$
B. equal to $2a$
C. between a and $2a$
D. whether it is greater than $2a$, equal to $2a$ or between a and $2a$ depends on the value of θ

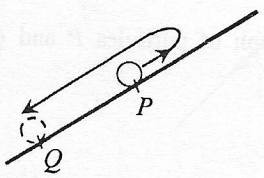
9. A particle moving along a straight line with speed 0.5 m s^{-1} changes its direction of motion within a period of 0.2 s and subsequently travels with the same speed in the opposite direction. Find the magnitude of its average acceleration during this 0.2 s.

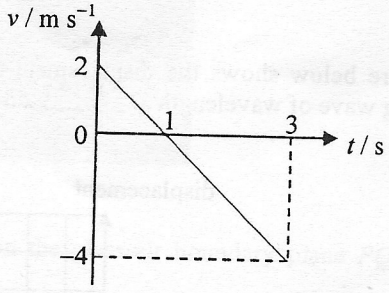
A. 5 m s^{-2}
B. 2.5 m s^{-2}
C. 0 m s^{-2}
D. its magnitude depends on the mass of the particle

10. A train departs from one station and stops at the next station after travelling 1.2 km along a straight line. The maximum acceleration and deceleration of the train are both 5 m s^{-2} and the highest speed of the train is limited to 20 m s^{-1}. Find the shortest time taken for this trip.

A. 56 s
B. 58 s
C. 62 s
D. 64 s

11. A bead is projected up along a smooth incline at point P at time $t = 0$. After reaching the highest point, the bead then travels downwards and passes point Q at $t = 3$ s as shown. The velocity-time (v-t) relationship of the bead is shown in the graph below. Find the separation PQ along the incline.





A. 2 m
B. 3 m
C. 4 m
D. 5 m

12. At a certain instant, an object flying horizontally to the right at 1 m s^{-1} suddenly explodes into two fragments of mass ratio 1 : 2. If just after the explosion the more massive fragment flies to the right at 3 m s^{-1}, what would happen to the other fragment just after the explosion ?

A. It would fly to the left at 3 m s^{-1}.
B. It would fly to the left at 4 m s^{-1}.
C. It would be momentarily at rest.
D. It would fly to the right at 1 m s^{-1}.

*13. A satellite of mass m moves around a planet of mass M in a circular orbit of radius r. What does the angular velocity of the satellite depend on ?

(1) r
(2) m
(3) M

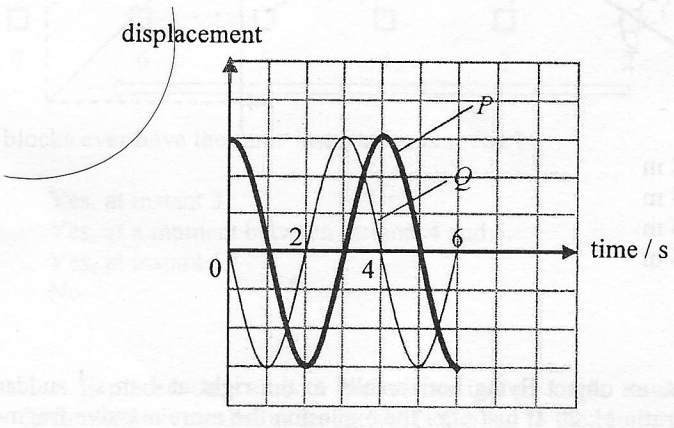
A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

14. Which of the following statements about waves is/are correct ?

(1) Longitudinal waves can transmit energy from one place to another but transverse waves cannot.
(2) Sound waves propagate faster in water than in air.
(3) Infra-red radiation is a kind of electromagnetic wave.

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

15. The figure below shows the displacement-time graph of particles P and Q on the same transverse travelling wave of wavelength λ.

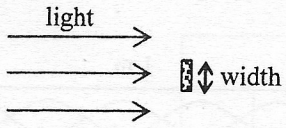


Which of the following statements **MUST BE** correct ? Upward displacement is taken to be positive.

(1) At time $t = 2$ s, P is momentarily at rest.
(2) At time $t = 4$ s, Q is moving downwards.
(3) The separation between the equilibrium positions of P and Q is 0.25λ.

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

16. Light undergoes diffraction round an obstacle.

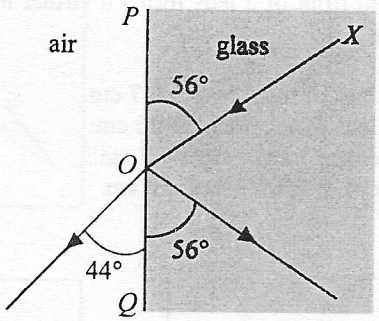


The angle of diffraction would increase when

(1) the amplitude of the incident light is increased.
(2) the width of the obstacle is increased.
(3) the wavelength of the incident light is increased.

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

17.



In the figure above, XO is a light ray incident on the glass-air boundary plane PQ. Which of the following gives the refractive index of glass ?

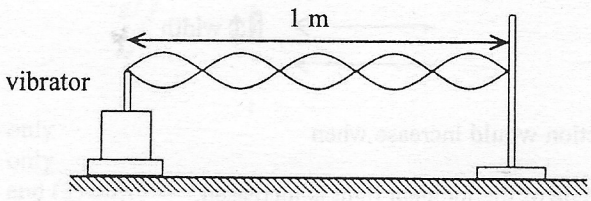
A. $\dfrac{\sin 56^\circ}{\sin 44^\circ}$

B. $\dfrac{\sin 44^\circ}{\sin 34^\circ}$

C. $\dfrac{\sin 56^\circ}{\sin 46^\circ}$

D. $\dfrac{\sin 46^\circ}{\sin 34^\circ}$

18. The figure shows a string with one end fixed and the other end tied to a vibrator. A stationary wave is formed as shown at a certain frequency.



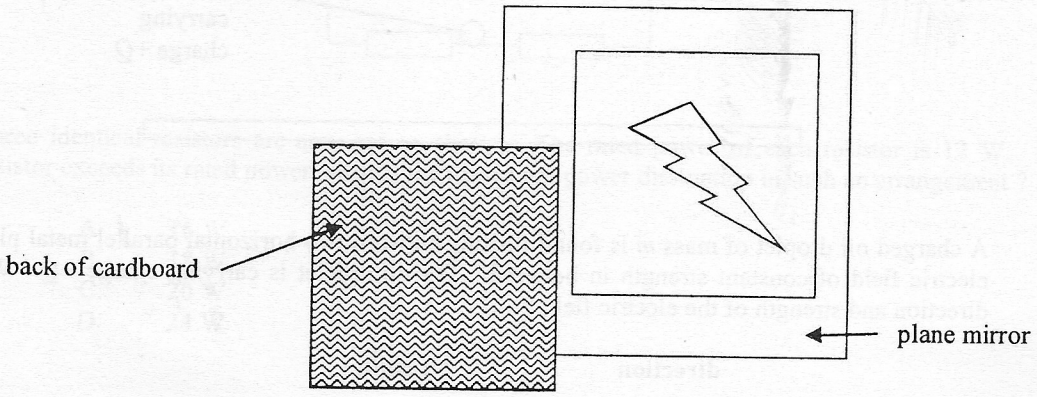
If the speed of the wave along the string is 7 m s^{-1}, what is the frequency of the wave ?

A. 2.8 Hz
B. 7 Hz
C. 17.5 Hz
D. 35 Hz

*19. An object placed 25.0 cm in front of a lens forms a virtual image at a distance 11.1 cm from the lens. The lens is a

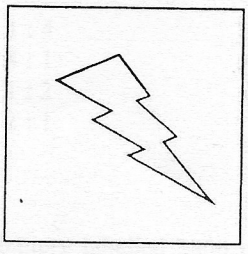
A. concave lens of focal length 7.7 cm.
B. concave lens of focal length 20 cm.
C. convex lens of focal length 7.7 cm.
D. convex lens of focal length 20 cm.

20. The figure shows the image seen when a plane mirror is placed in front of a cardboard with a design on its front surface.

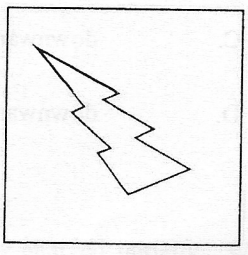


Which diagram below shows the design on the cardboard ?

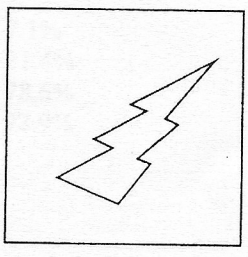
A.



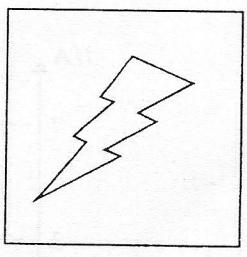
B.



C.



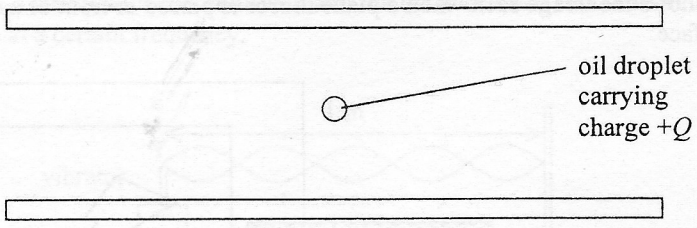
D.



21. Which of the following is **NOT** a typical sound intensity level that occurs in daily life ?

A. 130 dB : when an airplane take-off
B. 110 dB : at a rock concert
C. 80 dB : having a normal conversation
D. 30 dB : inside a library

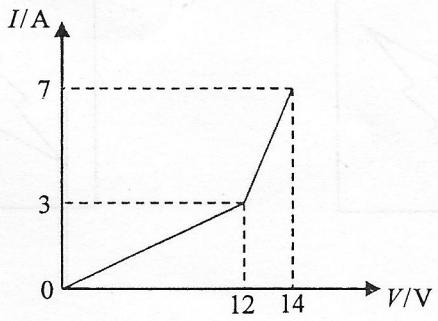
22.



A charged oil droplet of mass m is found floating between two horizontal parallel metal plates with an electric field of constant strength in between. The oil droplet is carrying charge $+Q$. What are the direction and strength of the electric field ?

	direction	strength
A.	upward	$\frac{mg}{Q}$
B.	upward	$\frac{Q}{mg}$
C.	downward	$\frac{mg}{Q}$
D.	downward	$\frac{Q}{mg}$

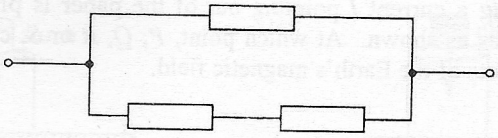
23. The graph below shows the current-voltage (I-V) relationship of a conductor.



Which statement below is **INCORRECT** ?

A. When the voltage across the conductor is less than 12 V, it obeys Ohm's law.
B. When the voltage across the conductor exceeds 12 V, its resistance begins to decrease.
C. The resistance of the conductor is 0.5 Ω when the current flowing through it is 5 A.
D. The resistance of the conductor is 2 Ω when the voltage across it is 14 V.

24.



Three identical resistors are arranged as shown. The rated power of each resistor is 12 W. If no resistor exceeds its rated power, what is the maximum power dissipation in such an arrangement ?

A. 16 W
B. 18 W
C. 20 W
D. 24 W

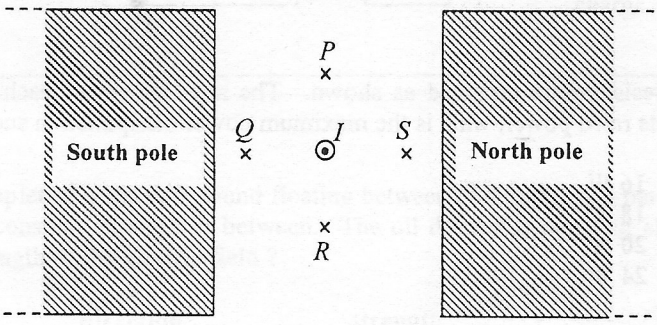
25. Two wires X and Y of the same length are made from different materials. The radius of X is half that of Y. When the two wires are connected in parallel to the same power supply, the current flowing through each wire is the same. What is the ratio of the resistivity of the material of X to that of Y ?

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

26. A mobile phone battery labelled 2800 mA h capacity is fully charged initially. What percentage of capacity remains after it has delivered a current of 200 mA for 3 hours ?

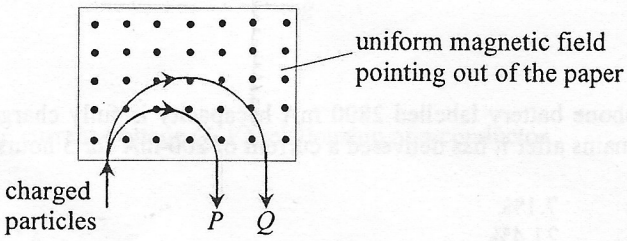
A. 7.1%
B. 21.4%
C. 78.6%
D. 92.9%

27. A straight wire carrying a current I pointing out of the paper is placed in a uniform magnetic field between two pole pieces as shown. At which point, P, Q, R or S, can the resultant magnetic field be zero ? Neglect the effects of the Earth's magnetic field.



A. P
B. Q
C. R
D. S

*28.

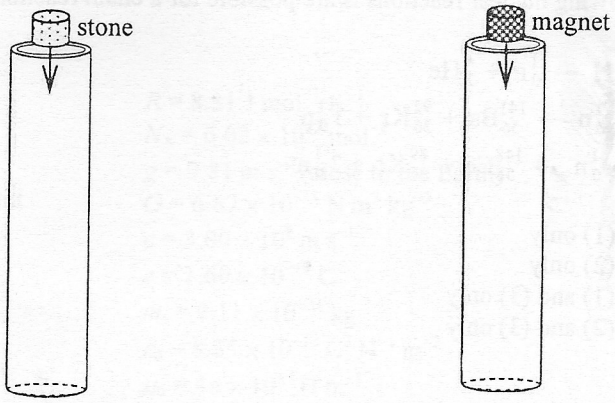


P and Q are two particles carrying the same amount of charge but of different masses. They travel with the same speed and enter a uniform magnetic field pointing out of the paper as shown. Semi-circular paths with different radii are described before they emerge from the field. Which descriptions below are correct ?

(1) Both P and Q are positively charged.
(2) P and Q emerge from the field with the same speed.
(3) The mass of Q is greater than that of P.

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

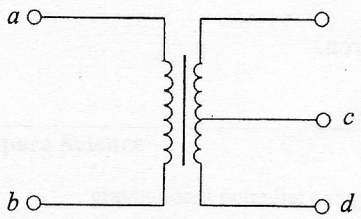
29.

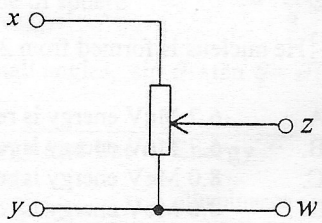


A stone and a strong magnet of the same size and shape are released from rest into a hollow aluminium tubing respectively. Which of the following is correct ? Neglect air resistance.

	drops slower	reason
A.	stone	the stone is more massive
B.	magnet	the stone is more massive
C.	stone	the magnet induces eddy current in the aluminium tubing
D.	magnet	the magnet induces eddy current in the aluminium tubing

*30. In the circuits below, if a 12 V sinusoidal a.c. is applied across *ab* and across *xy* respectively, the voltages across *cd* and *zw* are both 6 V. Now if a 6 V sinusoidal a.c. is applied across *cd* and across *zw* respectively, what would be the voltages across *ab* and *xy* respectively ?





	voltage across *ab*	voltage across *xy*
A.	12 V	12V
B.	12 V	6 V
C.	6 V	6 V
D.	12 V	0 V

31. Which of the following nuclear reactions is/are possible for a chain reaction to occur ?

(1) $^{2}_{1}\mathrm{H} + {}^{3}_{1}\mathrm{H} \rightarrow {}^{1}_{0}\mathrm{n} + {}^{4}_{2}\mathrm{He}$

(2) $^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{141}_{56}\mathrm{Ba} + {}^{92}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n}$

(3) $^{239}_{94}\mathrm{Pu} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{148}_{58}\mathrm{Ce} + {}^{89}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n}$

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

*32. X and Y are two radioactive nuclides. The ratio of the mass of an atom of X to that of an atom of Y is 1 : 2. The half-lives of X and Y are T and $2T$ respectively. If two samples consisting of purely X and Y respectively have the same initial mass, find the ratio of the number of undecayed nuclei of X to that of Y after a period of $4T$.

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

*33. Given: mass of proton = 1.007276 u
mass of neutron = 1.008665 u
mass of $^{3}_{2}\mathrm{He}$ nucleus = 3.016030 u
1 u = 931 MeV

When a $^{3}_{2}\mathrm{He}$ nucleus is formed from 2 protons and 1 neutron,

A. 6.7 MeV energy is released.
B. 6.7 MeV energy is required.
C. 8.0 MeV energy is released.
D. 8.0 MeV energy is required.

END OF SECTION A