



88046504

PHYSICS
STANDARD LEVEL
PAPER 1

Friday 5 November 2004 (afternoon)

45 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. Which of the following gives the approximate ratio of the separation of the molecules in water and in steam at atmospheric pressure?

	Water : Steam
A.	1 : 1
B.	1 : 10
C.	1 : 100
D.	1 : 1000

2. The resistive force F acting on a sphere of radius r moving at speed v through a liquid is given by

$$F = cvr$$

where c is a constant.

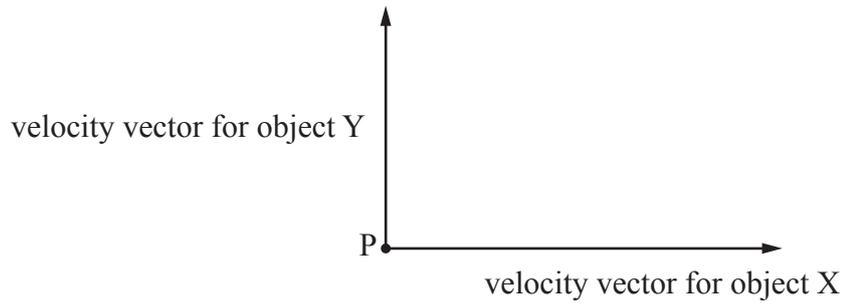
Which of the following is a correct unit for c ?

- A. N
- B. Ns^{-1}
- C. Nm^2s^{-1}
- D. Nm^{-2}s
3. Which of the following is the best estimate, to one significant digit, of the quantity shown below?

$$\frac{\pi \times 8.1}{\sqrt{(15.9)}}$$

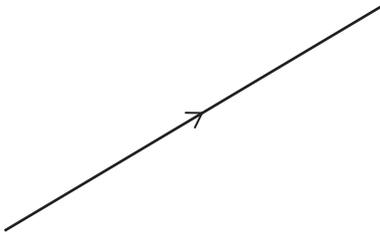
- A. 1.5
- B. 2.0
- C. 5.8
- D. 6.0

4. Two objects X and Y are moving away from the point P. The diagram below shows the velocity vectors of the two objects.

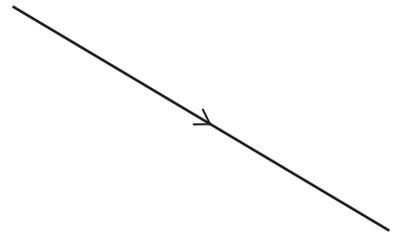


Which of the following velocity vectors best represents the velocity of object X relative to object Y?

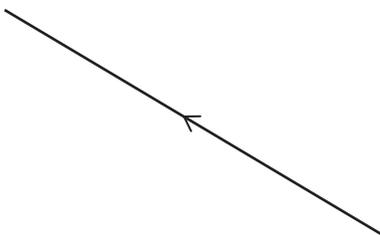
A.



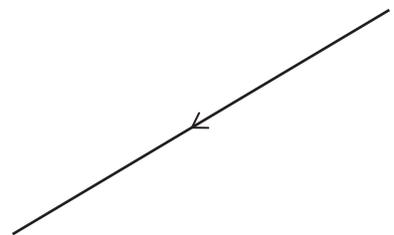
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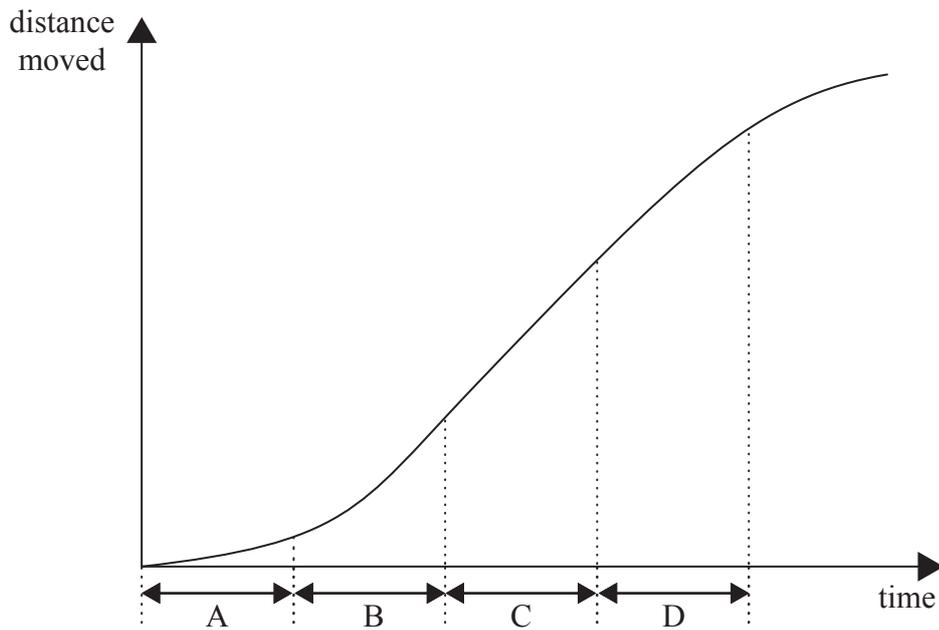
C.



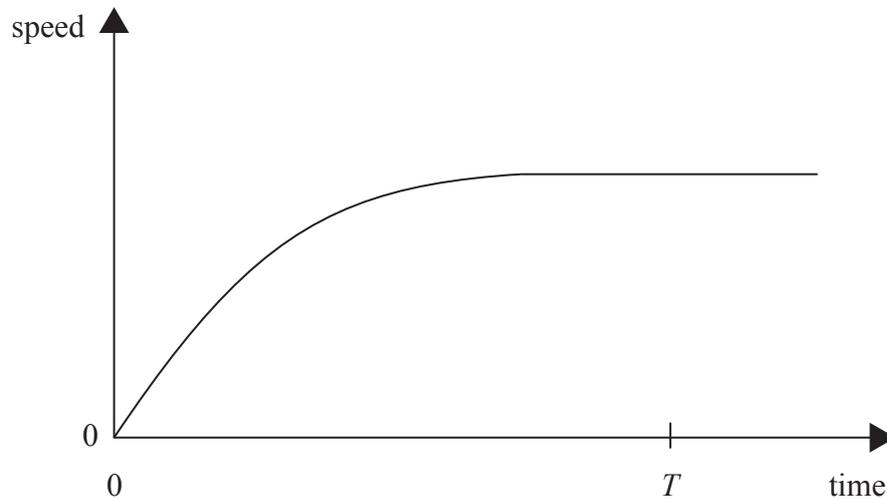
D.



5. The graph below shows the variation with time of the distance moved by a car along a straight road. During which time interval does the car have its greatest acceleration?



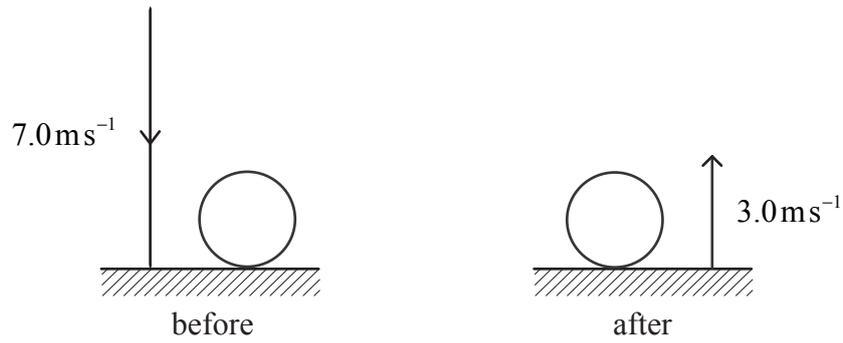
6. The variation with time of the vertical speed of a ball falling in air is shown below.



During the time from 0 to T , the ball gains kinetic energy and loses gravitational potential energy ΔE_p . Which of the following statements is true?

- A. ΔE_p is equal to the gain in kinetic energy.
- B. ΔE_p is greater than the gain in kinetic energy.
- C. ΔE_p is equal to the work done against air resistance.
- D. ΔE_p is less than the work done against air resistance.

7. A ball of mass 2.0 kg falls vertically and hits the ground with speed 7.0ms^{-1} as shown below.



The ball leaves the ground with a vertical speed 3.0ms^{-1} .

The magnitude of the change in momentum of the ball is

- A. zero.
 - B. 8.0 N s .
 - C. 10 N s .
 - D. 20 N s .
8. Two blocks having different masses slide down a frictionless slope.

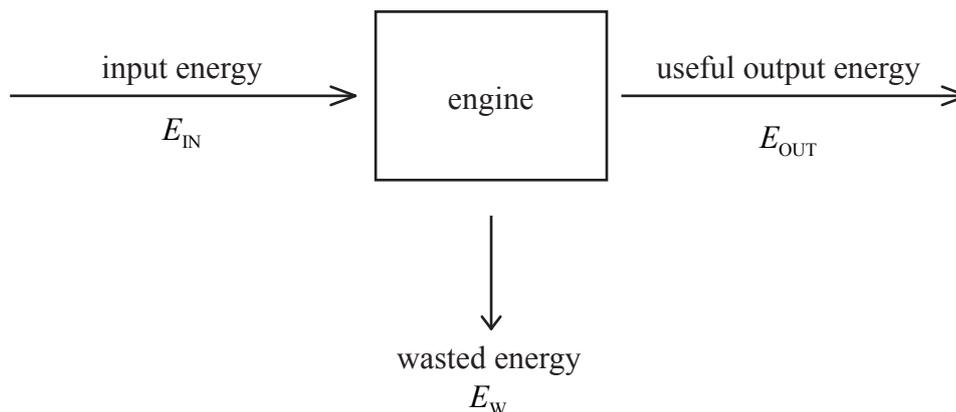
Which of the following correctly compares the accelerating force acting on each block and also the accelerations of the blocks down the slope?

	Accelerating force	Acceleration
A.	Equal	Equal
B.	Equal	Different
C.	Different	Equal
D.	Different	Different

9. The inertial mass of an object defines the property that
- A. keeps the object moving when no force acts on it.
 - B. is the ratio of resultant force acting on the object and its acceleration.
 - C. gives a measure of the amount of substance in the object.
 - D. is inversely proportional to the acceleration of the object.
10. Which of the following quantities are conserved in an inelastic collision in an isolated system of two objects?

	Linear momentum of system	Kinetic energy of system
A.	Yes	Yes
B.	Yes	No
C.	No	Yes
D.	No	No

11. The diagram below represents energy transfers in an engine.



The efficiency of the engine is given by the expression

A. $\frac{E_W}{E_{IN}}$.

B. $\frac{E_W}{E_{OUT}}$.

C. $\frac{E_{OUT}}{E_{IN}}$.

D. $\frac{E_{OUT}}{E_W}$.

12. Which of the following involves a change in the **total** energy of the objects?

- A. Some ice and water as the ice melts at constant temperature.
- B. An electron accelerated by a magnetic field.
- C. A satellite in a circular orbit round the Earth.
- D. A stone falling in a vacuum towards the Earth's surface.

13. The centripetal force F acting on a particle of mass m that is travelling with linear speed v along the arc of a circle of radius r is given by

A. $F = \frac{v^2}{mr}$.

B. $F = mv^2r$.

C. $F = mr^2v$.

D. $F = \frac{mv^2}{r}$.

14. A temperature scale is to be constructed using the property X of a substance.

Which of the following must be a characteristic of the property X?

- A. The value of the property must be zero at zero kelvin.
- B. The property must increase with increase of temperature.
- C. The property must have a different value at each temperature to be measured.
- D. The value of the property must vary linearly with kelvin temperature.

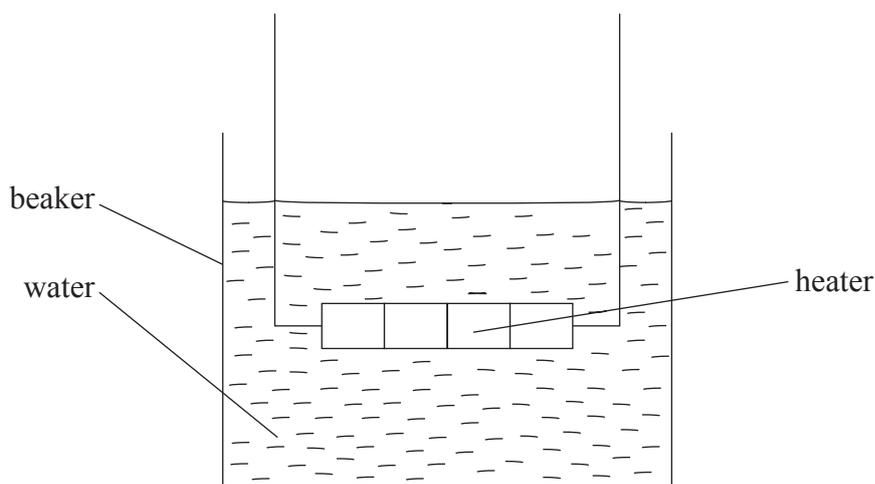
15. Thermal energy may be transferred

- I. in a fluid as a result of density changes of the fluid.
- II. in a non-metallic substance as a result of lattice vibrations.

Which of the following correctly identifies each of these energy transfers?

	Transfer I	Transfer II
A.	Convection	Convection
B.	Evaporation	Convection
C.	Convection	Conduction
D.	Evaporation	Conduction

16. Which of the following is **not** an assumption on which the kinetic model of an ideal gas is based?
- A. All molecules behave as if they are perfectly elastic spheres.
 - B. The mean-square speed of the molecules is proportional to the kelvin temperature.
 - C. Unless in contact, the forces between molecules are negligible.
 - D. The molecules are in continuous random motion.
17. As part of an experiment to determine the latent heat of vaporisation of water, a student boils some water in a beaker using an electric heater as shown below.



The student notes two sources of error.

- Error 1: thermal energy is lost from the sides of the beaker
- Error 2: as the water is boiling, water splashes out of the beaker

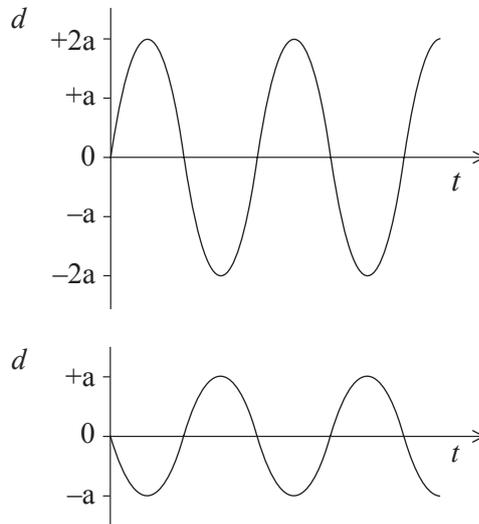
Which of the following gives the correct effect of these two errors on the calculated value for the specific latent heat?

	Error 1	Error 2
A.	Increase	Decrease
B.	Increase	No change
C.	Decrease	Increase
D.	Decrease	No change

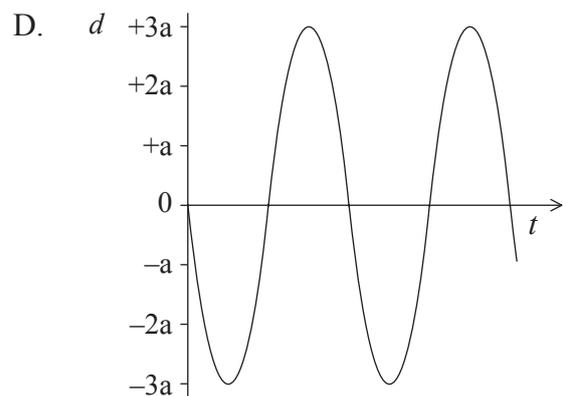
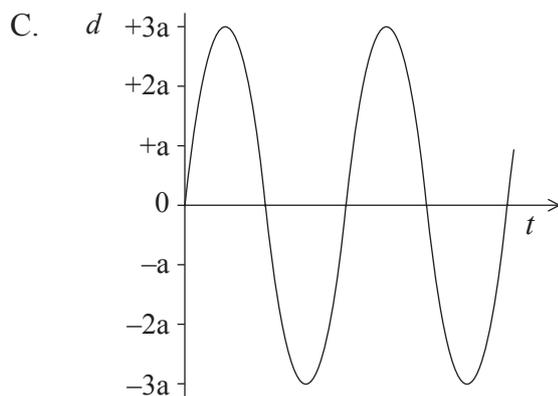
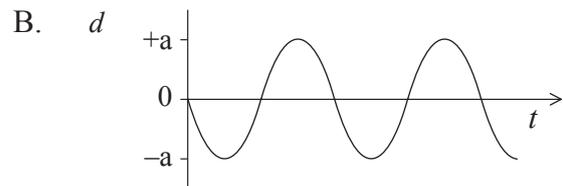
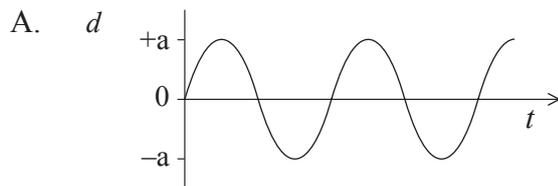
18. What change, if any, occurs in the wavelength and frequency of a light wave as it crosses a boundary from air into glass?

	Wavelength	Frequency
A.	Decreases	Decreases
B.	Decreases	Unchanged
C.	Increases	Increases
D.	Increases	Unchanged

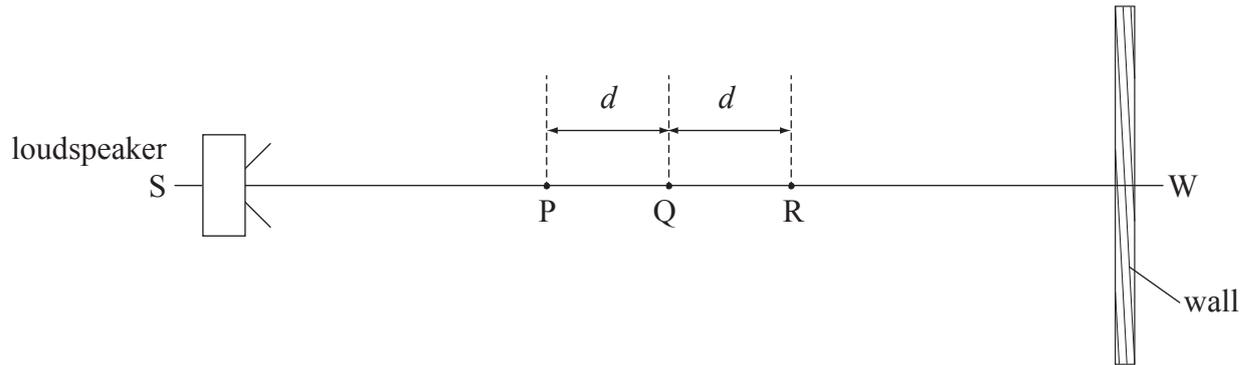
19. The variation with time t of the separate displacements d of a point in a medium due to two waves are shown below.



The waves are superposed. Which of the following diagrams shows the variation with time t of the resultant displacement d of the point in the medium?



20. A loudspeaker emits sound of frequency f . The sound waves are reflected from a wall. The arrangement is shown below.

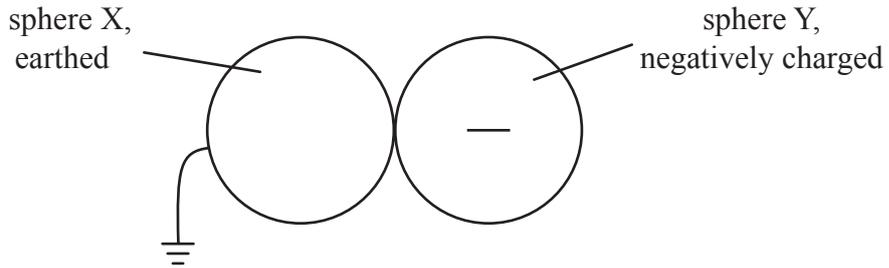


When a microphone is moved along the line SW, minimum loudness of sound is detected at points P, Q and R. There are no other minima between these points. The separation of the minima is d .

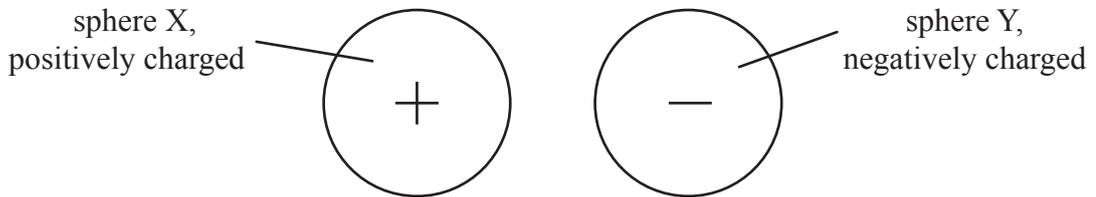
The speed of the sound wave is

- A. $\frac{1}{2}fd$.
- B. $\frac{f}{d}$.
- C. fd .
- D. $2fd$.

21. Two isolated spheres X and Y of unknown materials are touching one another as shown below.



Sphere Y is negatively charged and sphere X is earthed. The earth connection is removed from sphere X and then the spheres are separated as shown below.

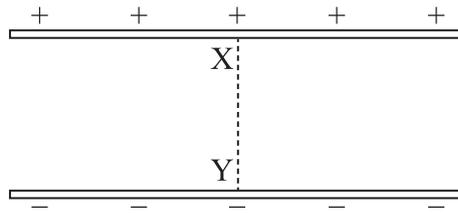


Sphere X is found to be positively charged and sphere Y remains negatively charged.

Which of the following describes the nature of the materials from which the spheres are made?

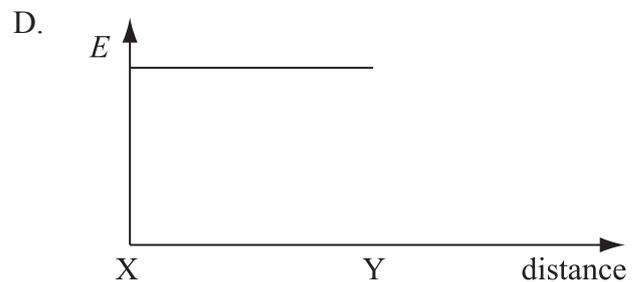
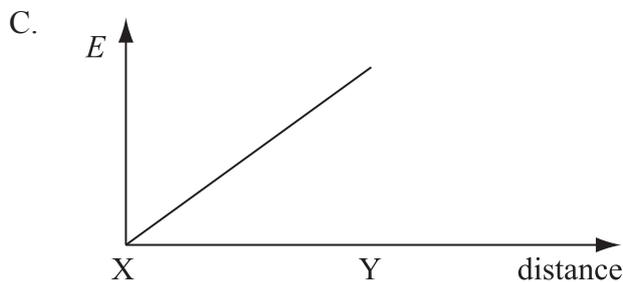
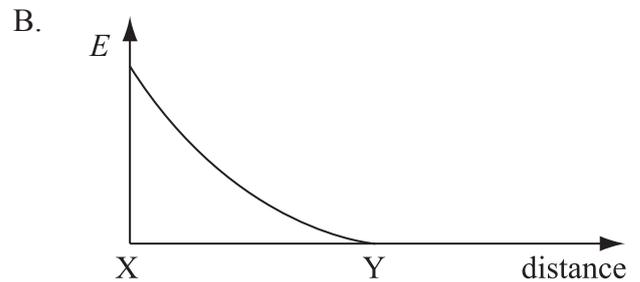
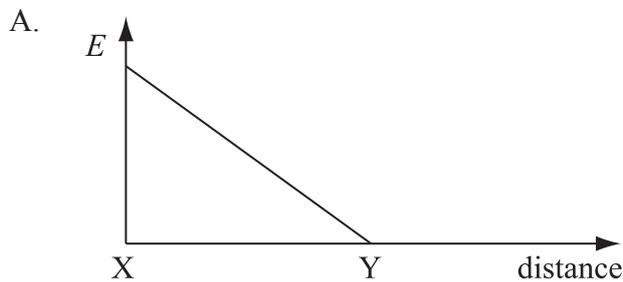
	Sphere X	Sphere Y
A.	Insulator	Insulator
B.	Insulator	Conductor
C.	Conductor	Insulator
D.	Conductor	Conductor

22. The diagram below shows two parallel conducting plates that are oppositely charged.



The line XY is perpendicular to the plates.

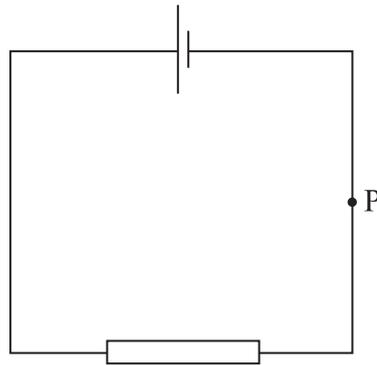
Which of the following diagrams shows the variation along the line XY of the magnitude E of the electric field strength between the plates?



23. The electron volt is **defined** as

- A. a unit of energy exactly equal to 1.6×10^{-19} J.
- B. a fraction $\frac{1}{13.6}$ of the ionization energy of atomic hydrogen.
- C. the energy gained by an electron when it moves through a potential difference of 1.0 V.
- D. the energy transfer when 1.0 C of charge moves through a potential difference of 1.0 V.

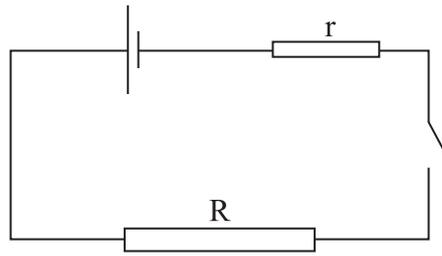
24. In the circuit below, n charge carriers pass the point P in a time t . Each charge carrier has charge q .



The current in the circuit is given by the expression

- A. $\frac{q}{t}$.
- B. $\frac{nq}{t}$.
- C. $\frac{qt}{n}$.
- D. nqt .

25. The current in the circuit shown below is constant when the switch is closed.

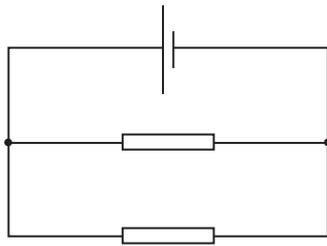


The energy transfer in the internal resistance r of the battery is 15 J when a charge of 40 C passes through it. For the same amount of charge, 45 J of energy is transferred in the resistor R .

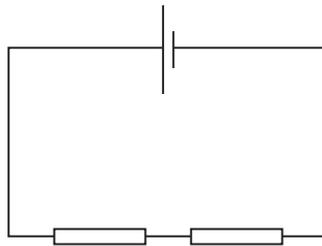
Which of the following gives the e.m.f. of the battery?

- A. $\frac{15}{40}$ V
- B. $\frac{30}{40}$ V
- C. $\frac{45}{40}$ V
- D. $\frac{60}{40}$ V

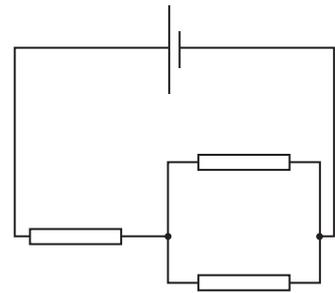
26. In the circuits below, the cells each have the same e.m.f. and zero internal resistance. All the resistors have the same resistance.



Circuit X



Circuit Y

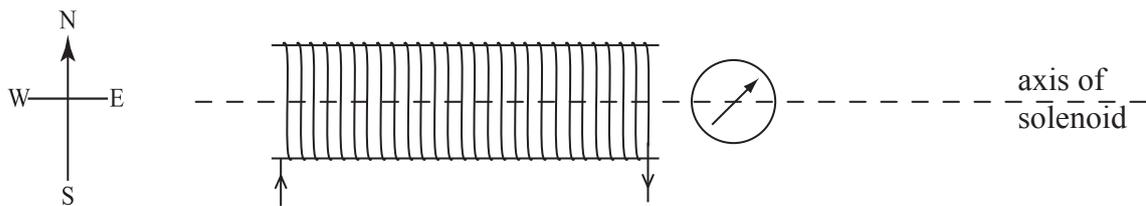


Circuit Z

Which of the following gives the current through the cells in order of **increasing** magnitude?

	Lowest current	→	Highest current
A.	X	Y	Z
B.	Z	X	Y
C.	Y	Z	X
D.	Y	X	Z

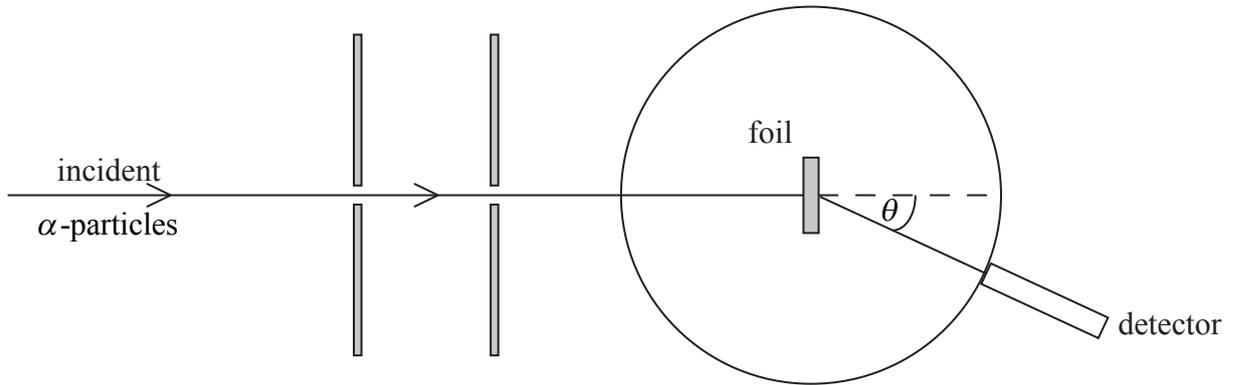
27. A current-carrying solenoid is placed with its axis pointing east-west as shown below. A small compass is situated near one end of the solenoid.



The axis of the needle of the compass is approximately 45° to the axis of the solenoid. The current in the solenoid is then doubled. Which of the following diagrams best shows the new position of the compass needle?

- A. B. C. D.

28. In an α -particle scattering experiment (Geiger-Marsden experiment), the number n of particles incident per unit time on a detector was determined for different angles of deflection θ .



Which of the following graphs best shows the variation with θ of n ?

- A.
- B.
- C.
- D.

29. The existence of isotopes provides evidence for the presence of
- A. electrons in atomic energy levels.
 - B. electrons in the nuclei of atoms.
 - C. neutrons in the nuclei of atoms.
 - D. protons in the nuclei of atoms.
30. When a high-energy α -particle collides with an aluminium-27 (${}^{27}_{13}\text{Al}$) nucleus, a nucleus of phosphorus may be produced. Which of the following equations correctly shows this transmutation?
- A. ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow {}^{30}_{15}\text{P} + {}^1_0\text{n}$
 - B. ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow {}^{30}_{15}\text{P} + {}^1_0\text{p}$
 - C. ${}^{27}_{13}\text{Al} + {}^2_1\text{He} \rightarrow {}^{28}_{14}\text{P} + {}^1_0\text{p}$
 - D. ${}^{27}_{13}\text{Al} + {}^2_1\text{He} \rightarrow {}^{28}_{14}\text{P} + {}^1_0\text{n}$
-