



PHYSICS
STANDARD LEVEL
PAPER 1

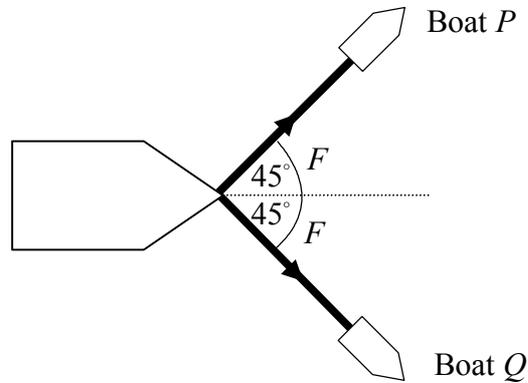
Tuesday 5 November 2002 (afternoon)

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. Two small identical boats, P and Q , are towing a larger boat which has its engines switched off. The magnitude of the towing force exerted by each small boat is F . The directions of the forces are shown in the diagram below.

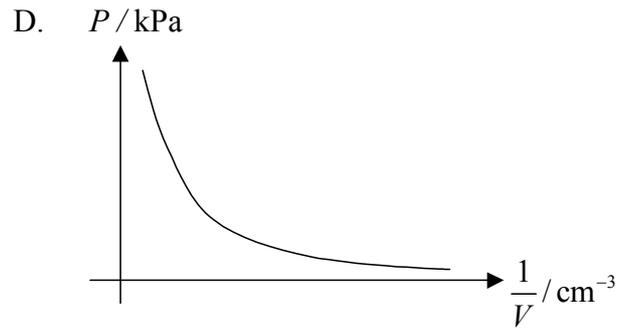
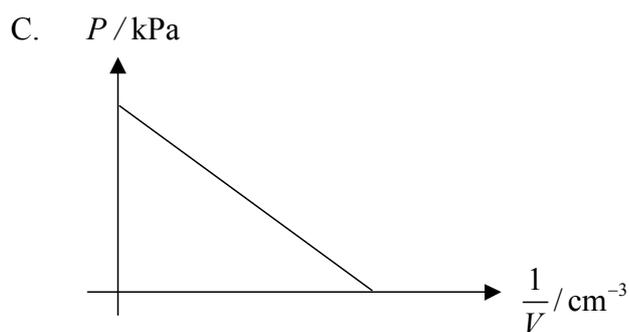
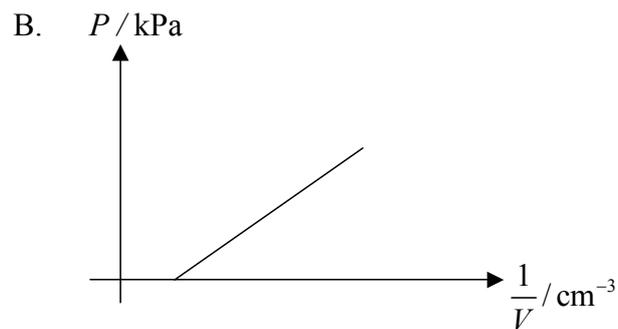
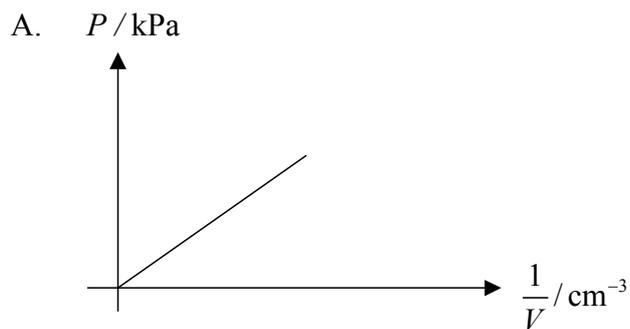


The magnitude of the **total** towing force on the large boat is

- A. F .
- B. $2F$.
- C. $\frac{F}{\sqrt{2}}$.
- D. $\sqrt{2} \times F$.

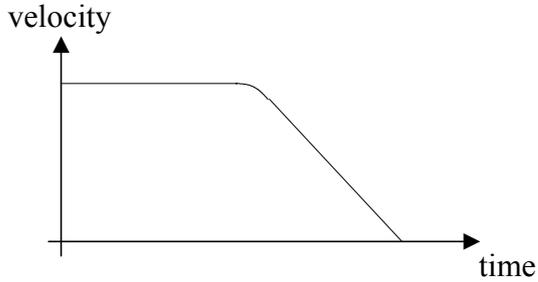
2. The pressure P , and volume V , of a sample of a gas are measured at constant temperature and a graph of P against $\frac{1}{V}$ is plotted.

Which **one** of the following graphs would be obtained if P is proportional to $\frac{1}{V}$ and there is a systematic error in the measurement of P ?

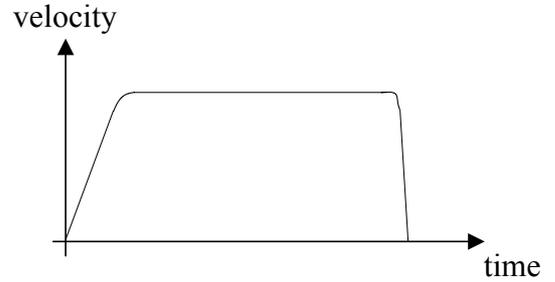


3. A woman parachutist jumps from a plane. After free falling for a short while, she opens her parachute and lands safely on the ground. Which **one** of the following graphs best shows how her velocity varies from the moment that she leaves the plane to the moment she lands on the ground?

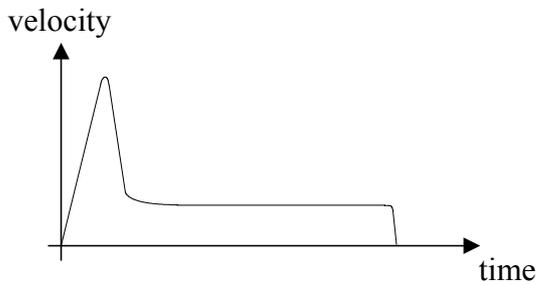
A.



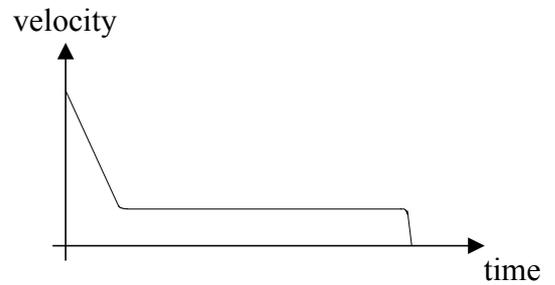
B.



C.

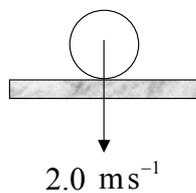


D.

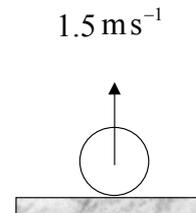


4. A ball is dropped on to a flat horizontal surface. Just before it hits the surface it is moving at a speed of 2.0 ms^{-1} . After bouncing, it leaves the surface at a speed of 1.5 ms^{-1} as shown in the diagrams below.

Just **before** hitting surface



Just **after** leaving surface



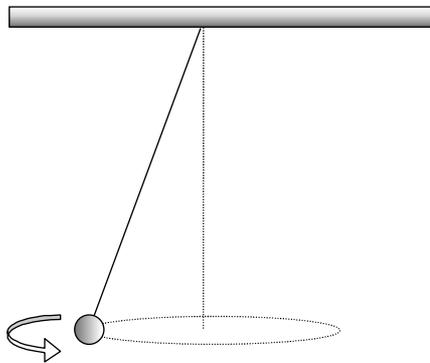
If the ball is in contact with the ground for 0.1 s , the magnitude of its average acceleration during contact with the ground is

- A. 35 ms^{-2} .
- B. 20 ms^{-2} .
- C. 15 ms^{-2} .
- D. 5 ms^{-2} .

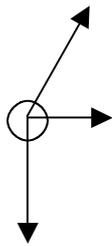
5. A car is travelling in a straight line along a horizontal road with speed v . The driver pushes the brake pedal and the maximum braking force is applied. The car travels a distance d in coming to rest. If the car had been travelling at twice the speed, $2v$, the distance travelled in coming to rest would be

- A. $4d$.
- B. $3d$.
- C. $2d$.
- D. d .

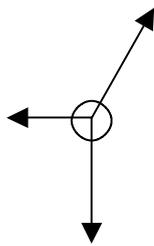
6. A ball is swinging in a horizontal circle as shown in the diagram below.



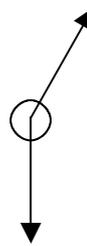
Which **one** of the following diagrams best shows the forces acting on the ball when it is at the position shown above?



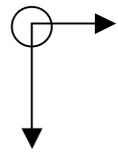
A.



B.

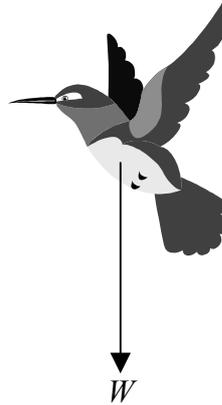


C.



D.

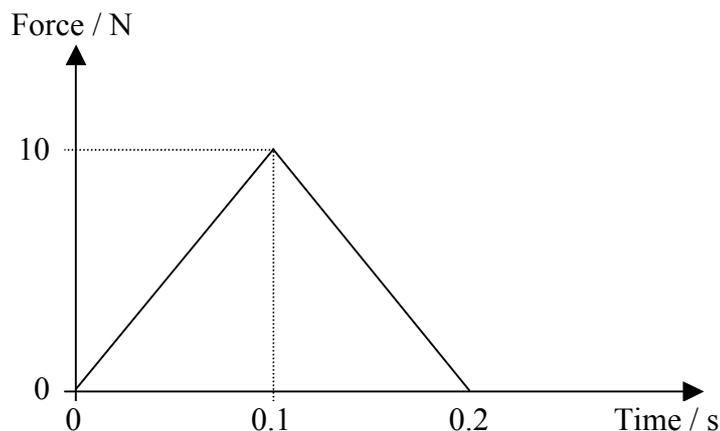
7. Newton's third law identifies **pairs** of forces that are equal in magnitude. One of the forces acting on a bird in flight is the gravitational force W downwards (exerted by the Earth) as shown below.



The Newton's third law force **that pairs with W** is the

- A. upwards force on the bird (exerted by the air).
 - B. downwards force on the air (exerted by the bird).
 - C. upwards force on the Earth (exerted by the bird).
 - D. downwards force on the Earth (exerted by the air).
8. A ball is thrown vertically upwards into the air. At the highest point, its **acceleration** is
- A. zero but about to become upwards.
 - B. zero but about to become downwards.
 - C. upwards.
 - D. downwards.

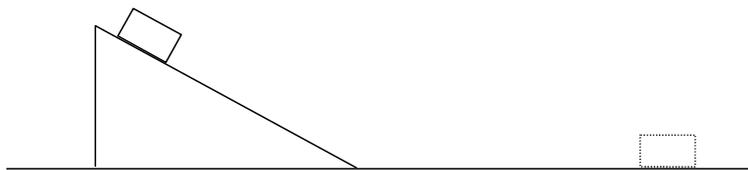
9. A varying force acts upon an object. The graph below shows how the force varies with time.



The impulse received by the object is

- A. 100 N s.
 - B. 10 N s.
 - C. 2 N s.
 - D. 1 N s.
10. A car **accelerates uniformly** from rest. It attains a speed v after having travelled a distance d . If air resistance can be ignored, the best estimate for the speed attained after having travelled a distance $2d$ is
- A. v .
 - B. $\sqrt{2}v$.
 - C. $2v$.
 - D. $4v$.

11. A block slides from rest down a smooth slope onto a rough horizontal floor where it comes to rest.

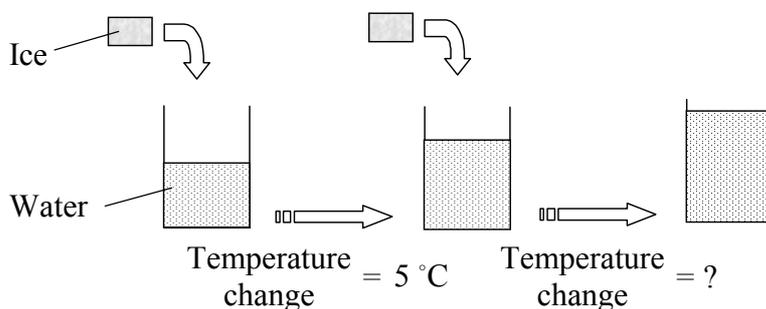


Which of the following best represents the energy changes taking place?

- A. Potential → kinetic → potential
 - B. Kinetic → potential → thermal
 - C. Potential → thermal → kinetic
 - D. Potential → kinetic → thermal
12. A substance changes from a solid to a liquid at **constant temperature**. Which **one** of the following correctly describes the changes in the average interatomic potential energy and the average kinetic energy of the molecules during the process?

	Average interatomic potential energy	Average kinetic energy
A.	Increases	Remains constant
B.	Remains constant	Increases
C.	Increases	Increases
D.	Remains constant	Remains constant

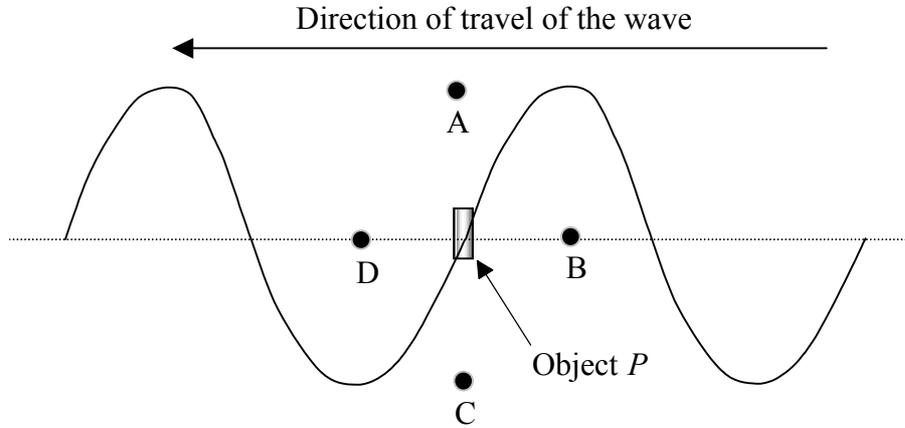
13. When a lump of ice was added to a beaker of warm water, the resulting water temperature was 5°C less than the initial temperature of the warm water.



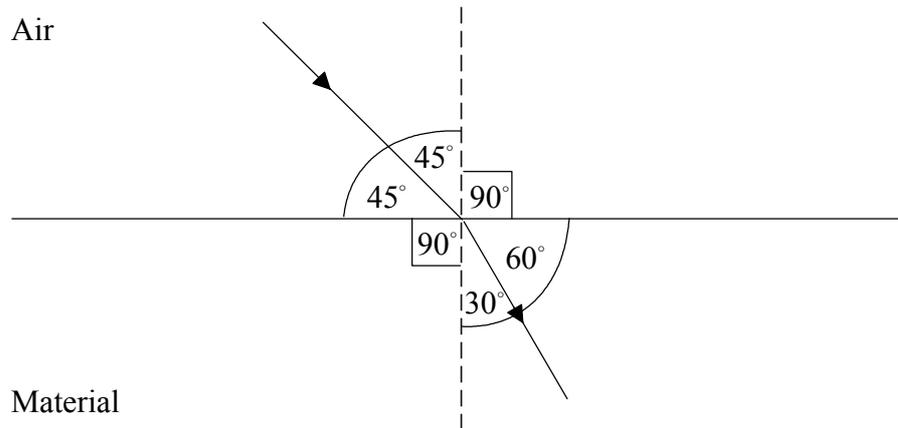
If another identical lump of ice is added to the same beaker, the temperature will

- A. go down by another 5°C .
 - B. not go down at all.
 - C. go down by more than 5°C .
 - D. go down by less than 5°C .
14. A fixed volume of an ideal gas is at a temperature of 27°C . In order to **double** the pressure at constant volume the temperature must be
- A. decreased to minus 123°C .
 - B. decreased to 13.5°C .
 - C. increased to 54°C .
 - D. increased to 327°C .
15. When a gas is compressed at constant temperature, the pressure increases. This is because the molecules of the gas
- A. repel each other.
 - B. are squashed together.
 - C. hit the walls of the container at a greater average speed.
 - D. hit the walls of the container more often in a given time.

16. The diagram below shows ripples on the surface of water at one instant of time. The ripples are moving **right to left** and a small object, *P*, is floating in the water. After a **quarter** of a time period, which letter correctly shows the position of the floating object?



17. Light is refracted at the interface between air and a material as shown below.



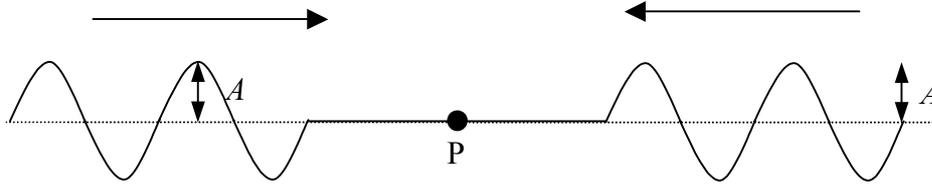
The table below lists the value for the sine of various angles.

Angle	0°	30°	45°	60°	90°
Sin (angle)	0.00	0.50	0.71	0.87	1.00

Which **one** of the following is the best estimate for the refractive index of the material?

- A. 0.8
- B. 1.2
- C. 1.4
- D. 1.7

18. Two waves of equal frequency, wavelength and amplitude, A , are travelling along a string towards the same point P as shown below.



If the waves arrive at P at the same time, which of the following best describes the subsequent motion of the string at point P?

- A. It will not move.
 - B. It will oscillate with amplitude A .
 - C. It will oscillate with amplitude $2A$.
 - D. It will oscillate with varying amplitude.
19. An organ pipe is closed at one end and open at the other as shown below.



Which **one** of the following diagrams correctly shows the positions of the displacement nodes and antinodes when the **fundamental** standing wave is formed in the tube?

- A.

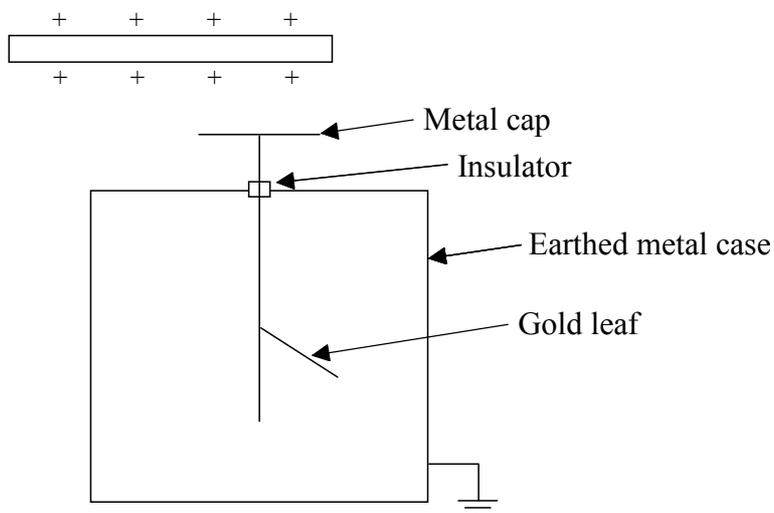
A. Node
Antinode
Node
- B.

B. Antinode
Node
Antinode
- C.

C. Antinode
Node
- D.

D. Node
Antinode

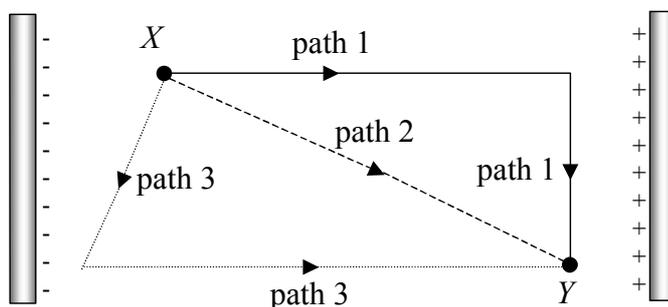
20. A positively charged rod is brought near to a **neutral** gold leaf electroscope and the leaf deflects as shown below.



Which line in the table below correctly indicates how the cap and leaf of the electroscope are now charged?

	Cap	Leaf
A.	Negative	Negative
B.	Negative	Positive
C.	Negative	Neutral
D.	Positive	Negative

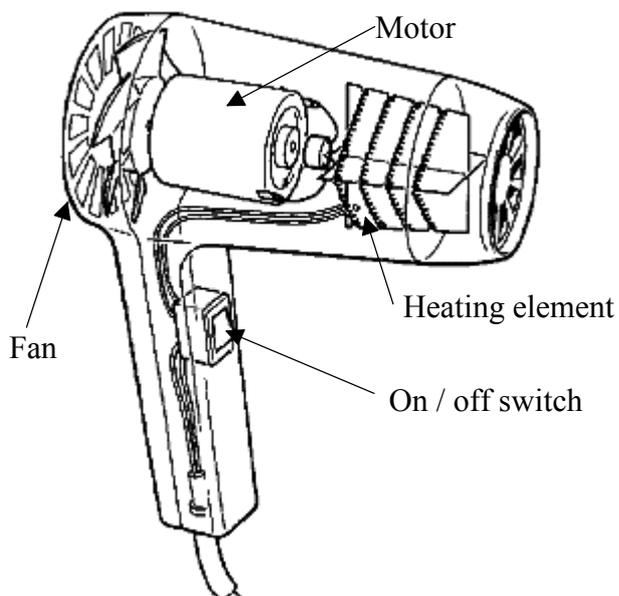
21. A small positively charged sphere is moved between two points X and Y that are between two parallel charged plates. Three paths between X and Y are shown.



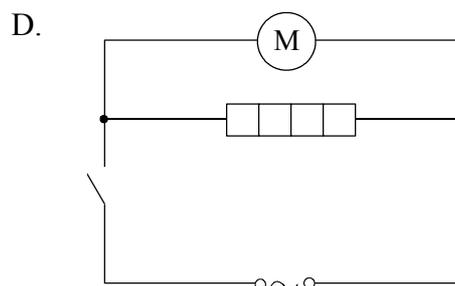
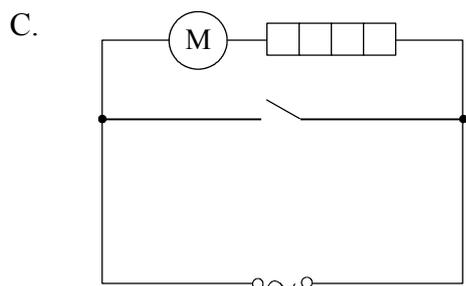
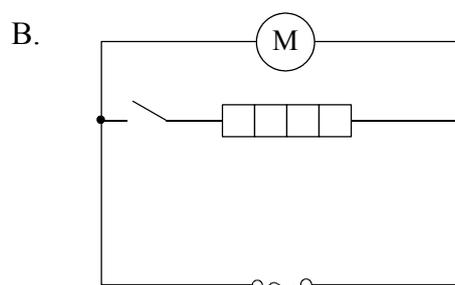
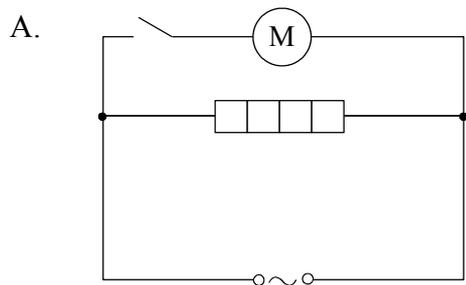
Which statement is correct?

- A. Path 1 requires the most amount of work.
 - B. Path 2 requires the most amount of work.
 - C. Path 3 requires the most amount of work.
 - D. All the paths require the same amount of work.
22. A wire obeys Ohm's law. When the potential difference across it is V , its resistance is r . If the potential difference is halved, then the resistance of the wire will
- A. double.
 - B. stay the same.
 - C. halve.
 - D. quadruple.

23. A simple hairdryer that blows out hot air contains the components shown below. When it is connected to the mains and the switch is turned on, the motor **and** the heating element both operate together.

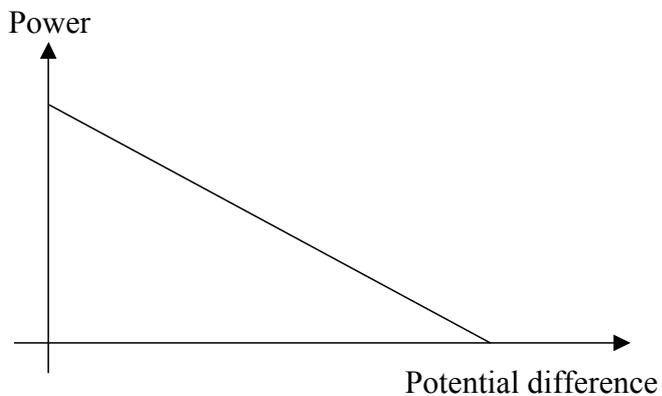


Which **one** of the following diagrams represents the electrical circuit in the hairdryer?

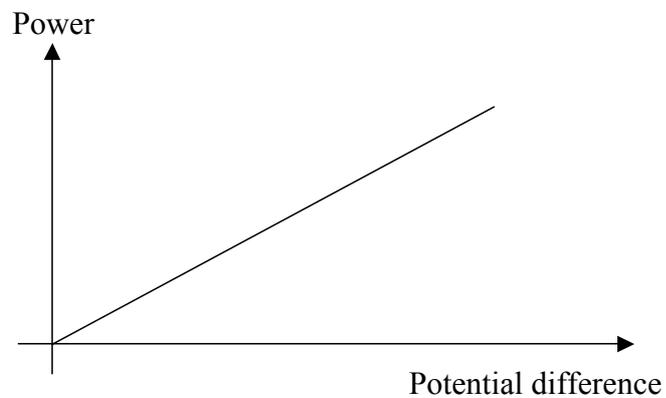


24. Which **one** of the following graphs best represents how the power dissipated in the filament of an electric light bulb varies with the potential difference across the filament?

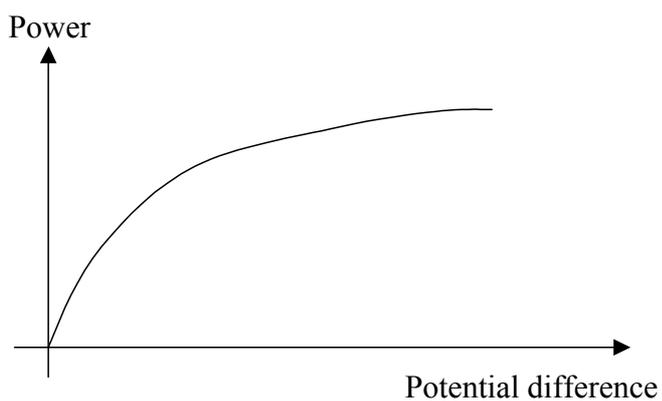
A.



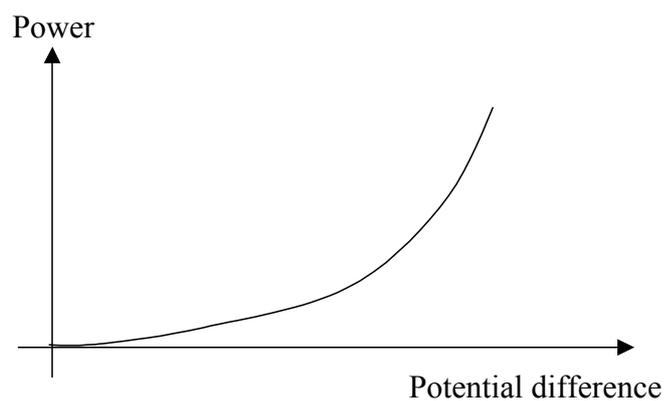
B.



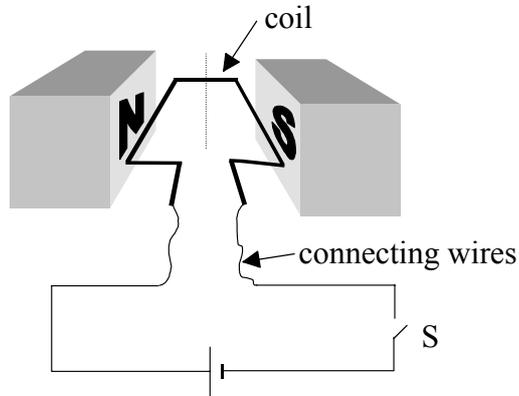
C.



D.

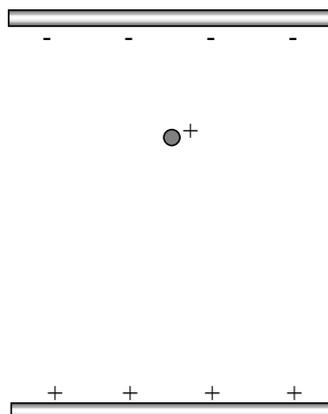


25. Jorge builds a simple electric motor but makes a mistake. He forgets to include the commutator and brushes and connects the coil directly to the power supply. The setup is represented in the diagram below (only one turn of the coil is shown).



- With the coil in the position shown, when the switch S is closed the coil will
- A. rotate normally – but the wires would tangle.
 - B. stop after half a revolution.
 - C. stop after a quarter of a revolution.
 - D. not move.
26. The output voltage from a step-up transformer is greater than the input voltage. This does not contradict the law of conservation of energy because
- A. energy is taken from the mains supply.
 - B. energy is taken from the magnetic field.
 - C. the output current is less than the input current.
 - D. the efficiency of the transformer is greater than 1.

27. A positively charged oil drop is held stationary between two charged plates as shown below.



If a magnetic field B directed **into** the page is now applied, the charged drop would

- A. move into the page.
 - B. move upwards.
 - C. move to the right.
 - D. stay where it is.
28. In the alpha scattering experiment of Rutherford, Geiger and Marsden, alpha particles were incident on a thin gold foil. The **majority** of the alpha particles
- A. were stopped by the foil.
 - B. were virtually undeflected.
 - C. were deflected through large angles.
 - D. caused nuclear reactions in the foil.

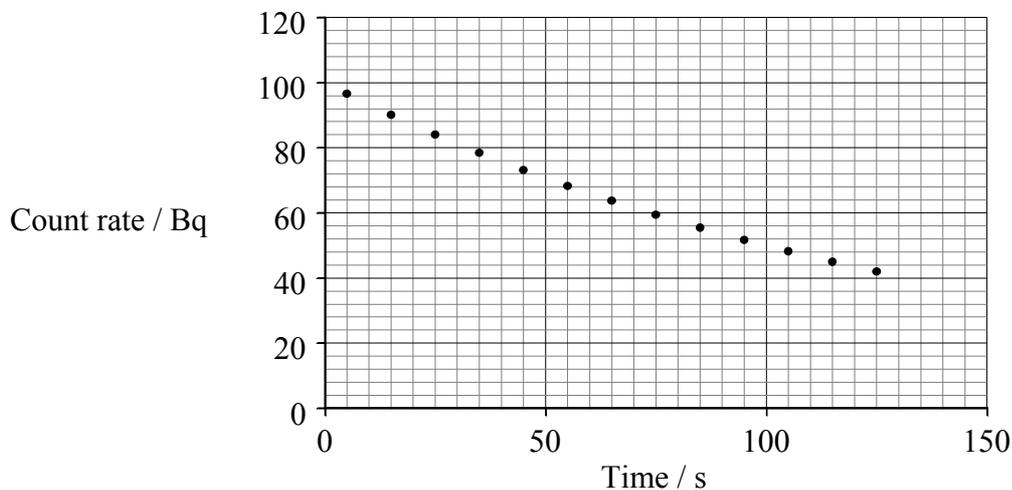
29. The nucleus of one of the isotopes of sodium is made up of the following particles.

Protons	Neutrons
11	14

An isolated atom of this isotope undergoes radioactive **beta** decay. Which **one** of the following choices correctly predicts the number of protons and neutrons that will remain after the decay?

	Protons	Neutrons
A.	11	14
B.	9	12
C.	12	13
D.	12	14

30. The count rate against time for a particular radioactive isotope is shown below.



The half-life, in seconds, for this radioactive isotope is approximately

- A. 50.
- B. 60.
- C. 100.
- D. 125.