



22056516

**PHYSICS**  
**STANDARD LEVEL**  
**PAPER 1**

Thursday 19 May 2005 (afternoon)

45 minutes

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**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.

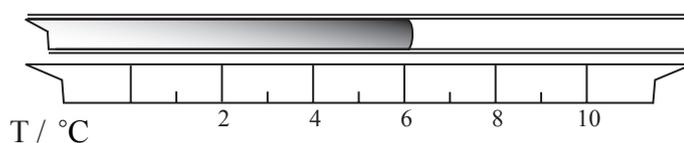
1. The ratio  $\frac{\text{diameter of hydrogen atom}}{\text{diameter of hydrogen nucleus}}$  to the nearest order of magnitude is

- A.  $10^2$ .
- B.  $10^5$ .
- C.  $10^{10}$ .
- D.  $10^{15}$ .

2. The kWh is equal to

- A.  $1.0 \times 10^3$  J.
- B.  $3.6 \times 10^3$  J.
- C.  $6.0 \times 10^4$  J.
- D.  $3.6 \times 10^6$  J.

3. The diagram below shows the position of the meniscus of the mercury in a mercury-in-glass thermometer.



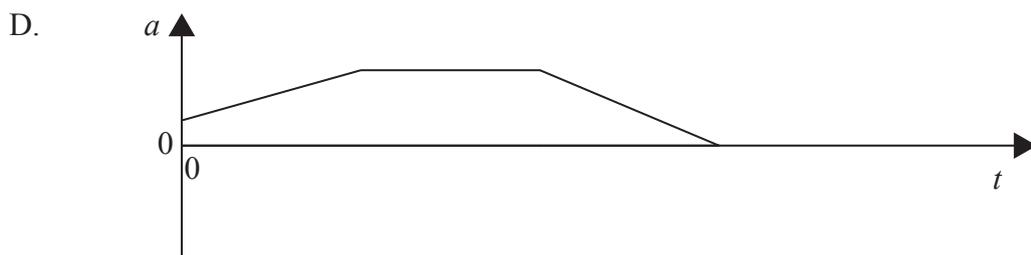
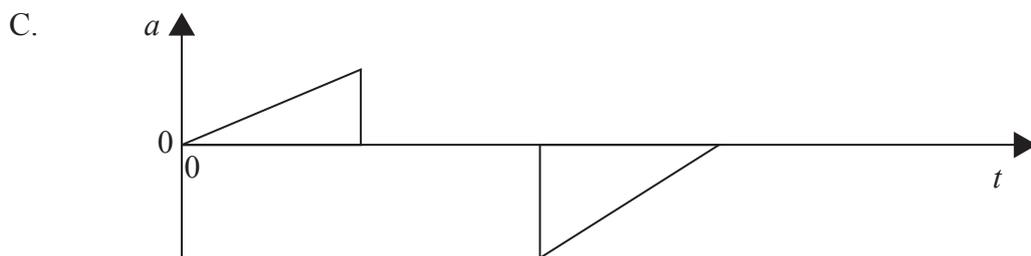
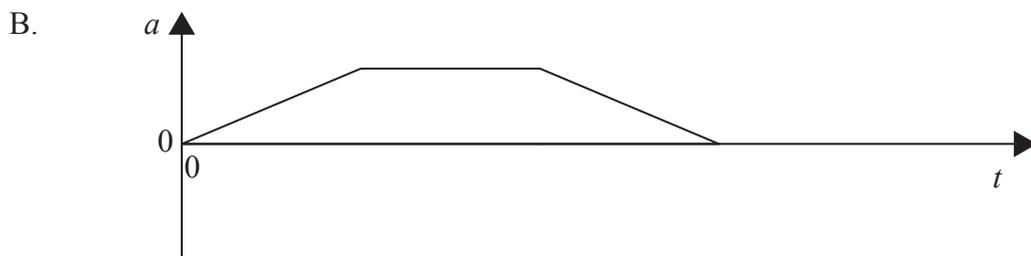
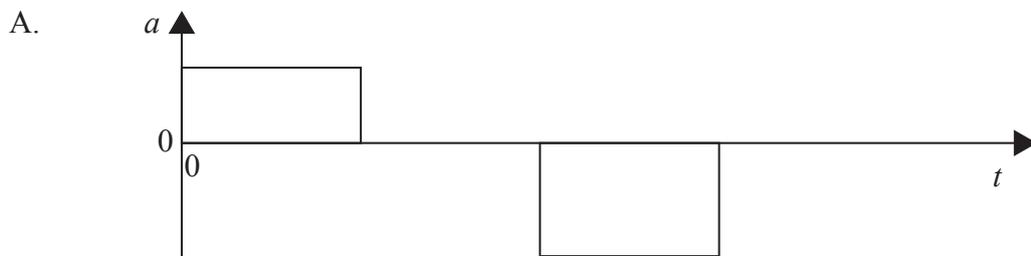
Which of the following best expresses the indicated temperature with its uncertainty?

- A.  $(6.0 \pm 0.5)^\circ\text{C}$
- B.  $(6.1 \pm 0.1)^\circ\text{C}$
- C.  $(6.2 \pm 0.2)^\circ\text{C}$
- D.  $(6.2 \pm 0.5)^\circ\text{C}$

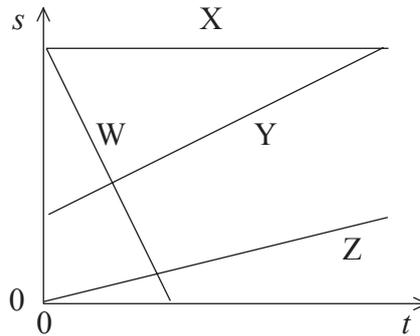
4. Which of the following represents two vector quantities?
- A. distance, acceleration
  - B. kinetic energy, work
  - C. force, momentum
  - D. electric field strength, electric potential

5. A car accelerates uniformly from rest. It then continues at constant speed before the brakes are applied, bringing the car to rest.

Which of the following graphs best shows the variation with time  $t$  of the **acceleration**  $a$  of the car?



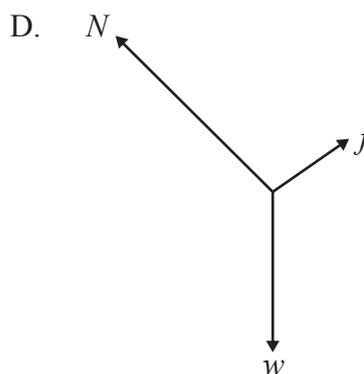
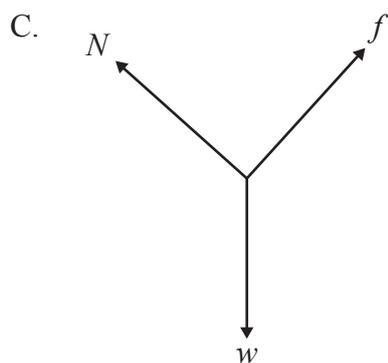
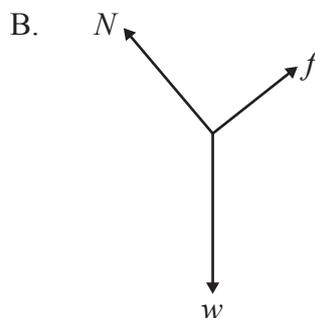
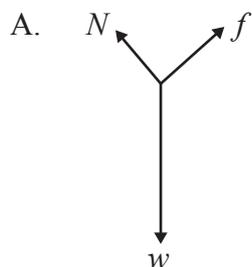
6. Four cars W, X, Y and Z are on a straight road. The graph below shows the variation with time  $t$  of the distance  $s$  of each car from a fixed point.



Which car has the greatest speed?

- A. W
  - B. X
  - C. Y
  - D. Z
7. A small boat in still water is given an initial horizontal push to get it moving. The boat gradually slows down. Which of the following statements is true for the forces acting on the boat as it slows down?
- A. There is a forward force that diminishes with time.
  - B. There is a backward force that diminishes with time.
  - C. There is a forward force and a backward force both of which diminish with time.
  - D. There is a forward force and a backward force that are always equal and opposite.

8. A friction force  $f$  is acting on a block of weight  $w$  sliding down an incline at a constant speed. The force  $N$  is the normal reaction of the incline on the block. Which of the following free-body diagrams best represents the forces acting on the block?

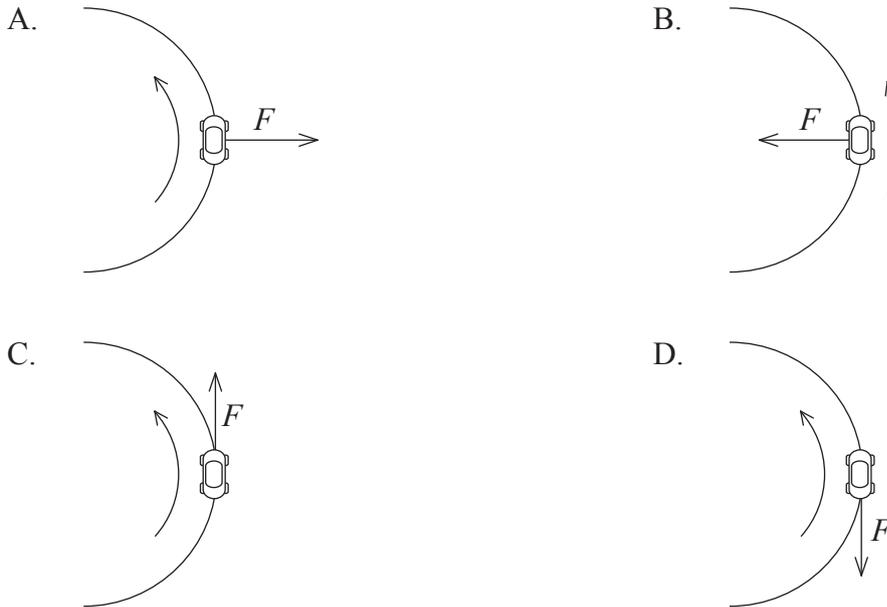


9. A body of mass  $m$  and speed  $v$  has kinetic energy  $E_K$ . A second body of mass  $\frac{m}{2}$  moves at speed  $2v$ . The kinetic energy of this second body is

- A.  $\frac{E_K}{2}$ .
- B.  $E_K$ .
- C.  $2E_K$ .
- D.  $4E_K$ .

10. The momentum of a system is conserved if
- A. no external forces act on the system.
  - B. no friction forces act within the system.
  - C. no kinetic energy is lost or gained by the system.
  - D. the forces acting on the system are in equilibrium.
11. A box of mass  $m$  is moved horizontally against a constant frictional force  $f$  through a distance  $s$  at constant speed  $v$ . The work done on the box is
- A. 0.
  - B.  $mgs$ .
  - C.  $\frac{1}{2}mv^2$ .
  - D.  $fs$ .
12. An electric motor, with an input power of 250 W, produces 200 W of mechanical power. The efficiency of the motor is
- A. 20 %.
  - B. 25 %.
  - C. 55 %.
  - D. 80 %.

13. Which of the following diagrams represents the direction of the centripetal force  $F$  acting on a car travelling in a circular path?



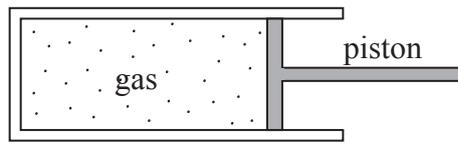
14. The Kelvin temperature of an ideal gas is a measure of the

- A. average speed of the molecules.
- B. average momentum of the molecules.
- C. average kinetic energy of the molecules.
- D. average potential energy of the molecules.

15. The specific latent heat of vaporisation of a substance is defined as the amount of thermal energy required to

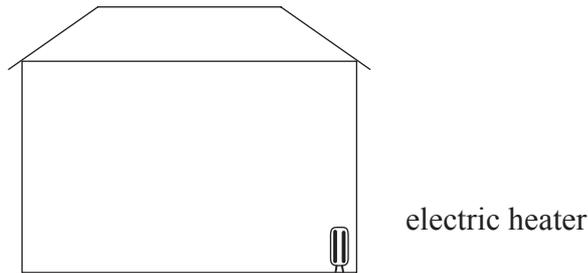
- A. change a liquid to vapour at constant pressure.
- B. change a liquid to vapour at constant temperature.
- C. change unit mass of liquid to vapour at constant pressure.
- D. change unit mass of liquid to vapour at constant temperature.

16. A gas is contained in a cylinder fitted with a piston as shown below.



When the gas is compressed rapidly by the piston its temperature rises **because** the molecules of the gas

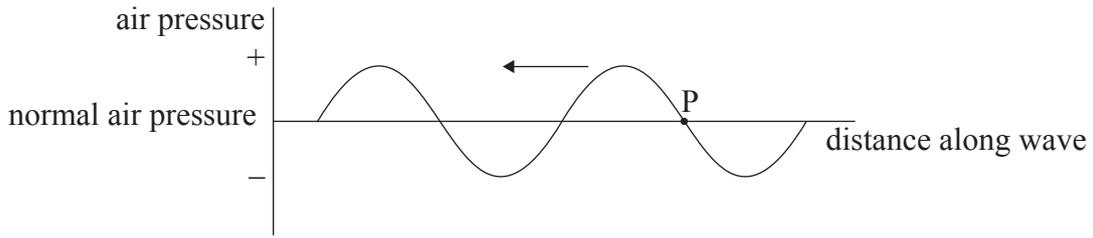
- A. are squeezed closer together.
  - B. collide with each other more frequently.
  - C. collide with the walls of the container more frequently.
  - D. gain energy from the moving piston.
17. The diagram below shows a room in a house fitted with an electric heater used to heat the room.



By which processes is the room heated when the heater is in operation?

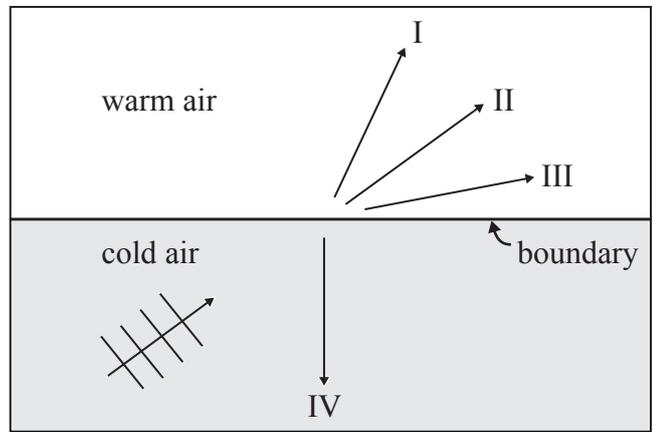
- A. Convection only
- B. Radiation only
- C. Radiation and convection
- D. Radiation and conduction

18. The graph below shows the variation of air pressure with distance along a wave at one given time. The arrow indicates the direction of travel of the wave.



The air pressure at point P is

- A. increasing.
  - B. decreasing.
  - C. constant.
  - D. zero.
19. Sound waves move faster in warm air than in cold air. The diagram below shows plane waves in cold air moving towards a boundary with warm air.



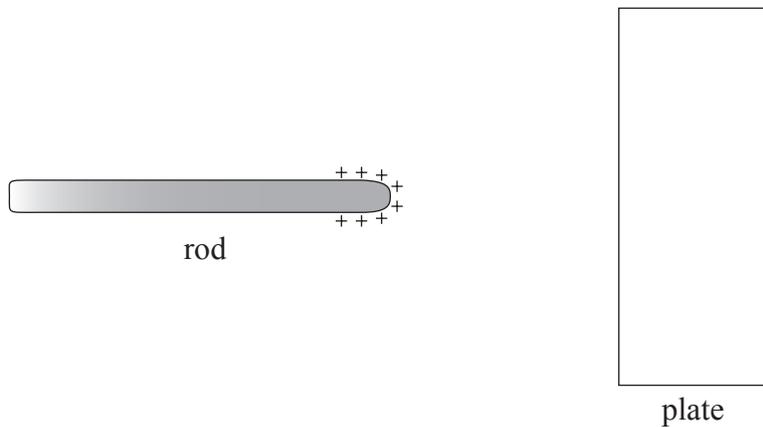
Which of the arrows shows the possible direction of waves after reaching the boundary?

- A. I
- B. II
- C. III
- D. IV

20. The speed of sound in still air is  $c$ . A source of sound moves away from an observer at speed  $v$ . What will be the speed of sound as measured by the observer?
- A.  $c$
  - B.  $c + v$
  - C.  $c - v$
  - D.  $v - c$

21. The fundamental frequency of a pipe closed at one end is  $f$ . A pipe of the same length but open at both ends has a fundamental frequency (first harmonic) of
- A.  $\frac{1}{2}f$ .
  - B.  $f$ .
  - C.  $2f$ .
  - D.  $4f$ .

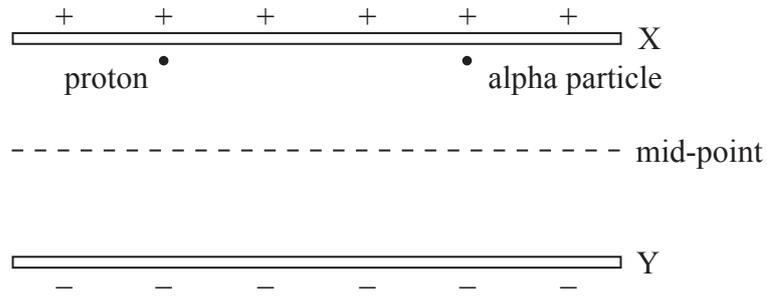
22. The diagram below shows a positively charged rod brought near an isolated uncharged metal plate.



As a result of bringing the rod near to the plate,

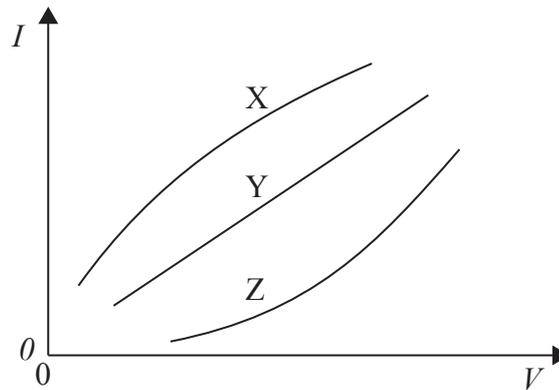
- A. the metal plate will gain a charge dependent on the separation of the rod and the plate.
- B. the metal plate will remain uncharged.
- C. the metal plate will gain a negative charge.
- D. the metal plate will gain a positive charge.

23. A proton and an alpha particle are accelerated from rest from the positively charged plate X to the negatively charged plate Y.



At the mid-point between the plates, the proton has a kinetic energy  $E_K$ . At this point, the alpha particle has a kinetic energy

- A.  $\frac{E_K}{2}$ .
  - B.  $E_K$ .
  - C.  $2E_K$ .
  - D.  $4E_K$ .
24. The graph below shows the variation with voltage  $V$  of the current  $I$  in three resistors X, Y and Z.



Which of the following corresponds to resistors for which the resistance increases with increasing current?

- A. X only
- B. Z only
- C. X and Z
- D. Y and Z

25. The element of an electric heater has a resistance  $R$  when in operation. What is the resistance of a second heater that has a power output three times as large at the same operating voltage?
- A.  $\frac{R}{9}$
  - B.  $\frac{R}{3}$
  - C.  $3R$
  - D.  $9R$
26. A magnetic force acts on an electric charge in a magnetic field when
- A. the charge is not moving.
  - B. the charge moves in the direction of the magnetic field.
  - C. the charge moves in the opposite direction to the magnetic field.
  - D. the charge moves at right angles to the lines of the magnetic field.
27. The emission and absorption spectra of different elements provides evidence for the existence of
- A. isotopes.
  - B. neutrons.
  - C. protons.
  - D. atomic energy levels.
28. The nucleus of an atom contains protons. The protons are prevented from flying apart by
- A. the presence of orbiting electrons.
  - B. the presence of gravitational forces.
  - C. the presence of strong attractive nuclear forces.
  - D. the absence of Coulomb repulsive forces at nuclear distances.

29. Which of the following gives the correct number of protons and number of neutrons in the nucleus of  ${}^1_5\text{B}$ ?

	Number of protons	Number of neutrons
A.	5	6
B.	5	11
C.	6	5
D.	11	5

30. The *unified mass unit* is defined as the rest mass of

- A. a proton.
  - B. an atom of carbon-12 divided by 12.
  - C. an atom of carbon-12.
  - D. an atom of hydrogen-1.
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