PHYSICS
STANDARD LEVEL
PAPER 1

Tuesday 4 May 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. The number of heartbeats of a person at rest in one hour, to the nearest order of magnitude is

A. 10^1.

B. 10^2.

C. 10^3.

D. 10^5.

2. The diameter of a proton is of the order of magnitude of

A. 10^{-12} m.

B. 10^{-15} m.

C. 10^{-18} m.

D. 10^{-21} m.

3. An ammeter has a zero offset error. This fault will affect

A. neither the precision nor the accuracy of the readings.

B. only the precision of the readings.

C. only the accuracy of the readings.

D. both the precision and the accuracy of the readings.

4. Which **one** of the following is a scalar quantity?

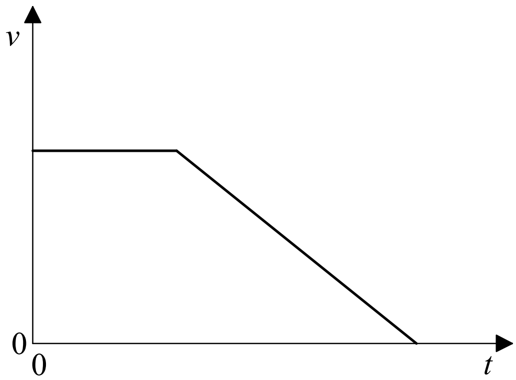
A. Pressure

B. Impulse

C. Magnetic field strength

D. Weight

The diagram below refers to questions 5 and 6. It shows the variation with time t of the velocity v of an object.



5. The area between the line of the graph and the time-axis represents

A. the average velocity of the object.

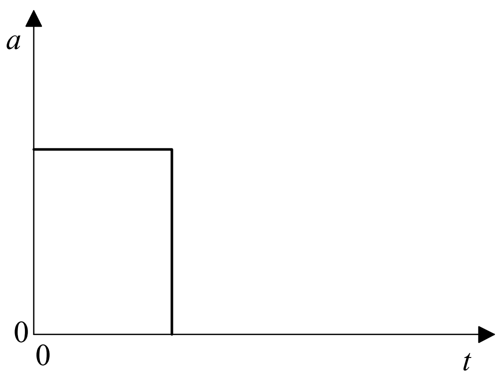
B. the displacement of the object.

C. the impulse acting on the object.

D. the work done on the object.

6. Which **one** of the following graphs shows the variation with time t of the acceleration a of the object?

A.



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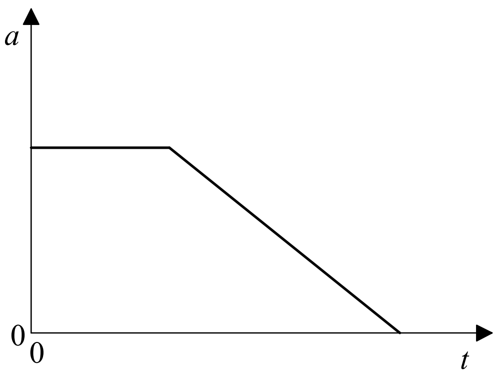

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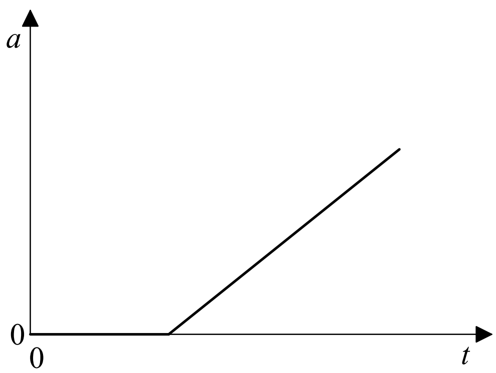

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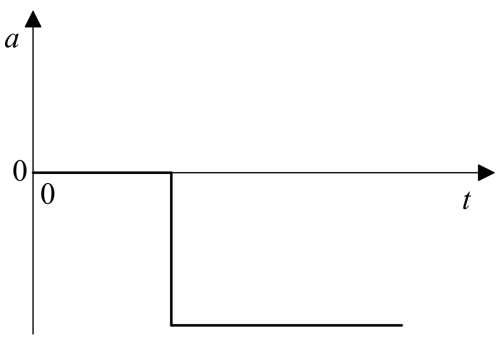


7. An object is taken from the Earth to the Moon. What change, if any, occurs in its gravitational mass and in its inertial mass?

	Gravitational mass	**Inertial mass**
A.	decreases	decreases
B.	decreases	unchanged
C.	unchanged	decreases
D.	unchanged	unchanged

8. For an object to be in translational equilibrium

A. it must be at rest.

B. it must be moving with a constant acceleration.

C. no external force must be acting on it.

D. the net force acting on it must be zero.

9. An astronaut in outer space is holding a hammer and drifting at constant velocity. The astronaut throws the hammer in the opposite direction to that in which she is drifting.

What change, if any, occurs in the total kinetic energy and the total momentum of the astronaut and hammer?

	Total kinetic energy	**Total momentum**
A.	unchanged	increased
B.	unchanged	unchanged
C.	increased	increased
D.	increased	unchanged

10. A constant force is applied to a ball of mass m. The velocity of the ball changes from v_1 to v_2. The impulse received by the ball is

A. $m(v_2 + v_1)$.

B. $m(v_2 - v_1)$.

C. $m(v_2^2 + v_1^2)$.

D. $m(v_2^2 - v_1^2)$.

11. An electric train develops a power of 1.0 MW when travelling at a constant speed of $50\ \mathrm{m\,s^{-1}}$. The net resistive force acting on the train is

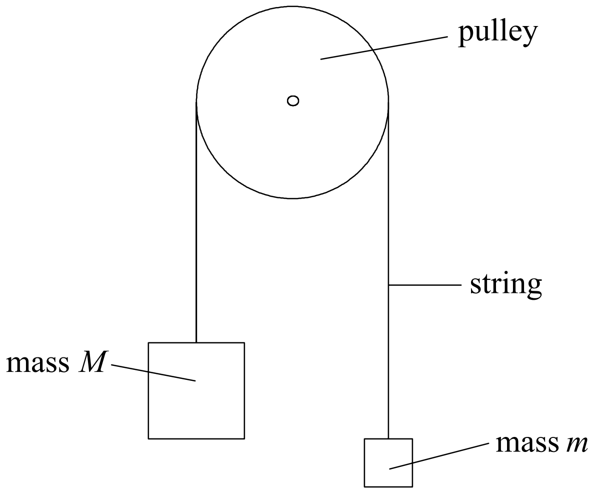
A. 50 MN.

B. 200 kN.

C. 20 kN.

D. 200 N.

12. A light inextensible string has a mass attached to each end and passes over a frictionless pulley as shown.



The masses are of magnitudes M and m, where $m < M$. The acceleration of free fall is g. The downward acceleration of the mass M is

A $\dfrac{(M-m)g}{(M+m)}$.

B. $\dfrac{(M-m)g}{M}$.

C. $\dfrac{(M+m)g}{(M-m)}$.

D. $\dfrac{Mg}{(M+m)}$.

13. A stone of mass m is attached to a string and moves round in a horizontal circle of radius R at constant speed V. The work done by the pull of the string on the stone in one complete revolution is

A. zero.

B. $2\pi m V^2$.

C. $\dfrac{2\pi m V^2}{R}$.

D. $\dfrac{2\pi m V}{R}$.

14. The distance between the $0^\circ C$ and $100^\circ C$ marks on a mercury-in-glass thermometer is 20 cm. When the thermometer bulb is placed in a mixture of ice and salt, the mercury level is 4 cm below the $0^\circ C$ mark. The temperature of the mixture is

A. $+20^\circ C$.

B. $+5^\circ C$.

C. $-5^\circ C$.

D. $-20^\circ C$.

15. Some liquid is contained in a shallow dish that is open to the atmosphere. The rate of evaporation of the liquid does **not** depend on

A. the temperature of the liquid.

B. the temperature of the atmosphere.

C. the depth of the liquid.

D. the pressure of the atmosphere.

16. The equation of state for an ideal gas, $pV = nRT$, describes the behaviour of real gases

A. only at low pressures and large volumes.

B. only at high temperatures.

C. only at large volumes and large pressures.

D. at all pressures and volumes.

17. The temperature of an ideal gas is reduced. Which **one** of the following statements is true?

A. The molecules collide with the walls of the container less frequently.

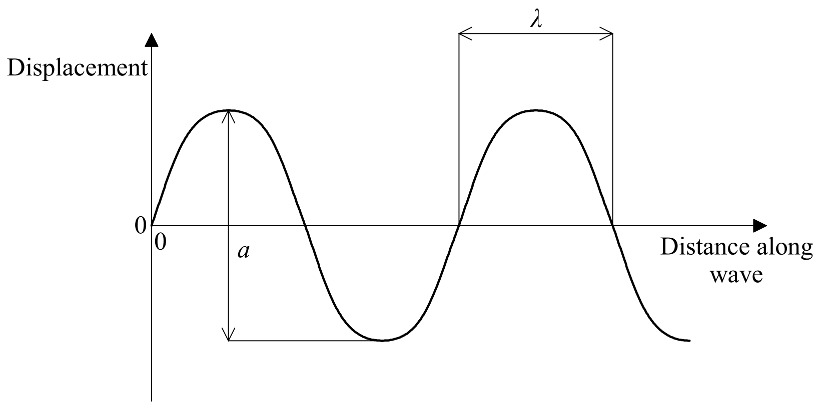
B. The molecules collide with each other more frequently.

C. The time of contact between the molecules and the wall is reduced.

D. The time of contact between molecules is increased.

18. On which **one** of the following graphs is the wavelength λ and the amplitude a of a wave correctly represented?

A.



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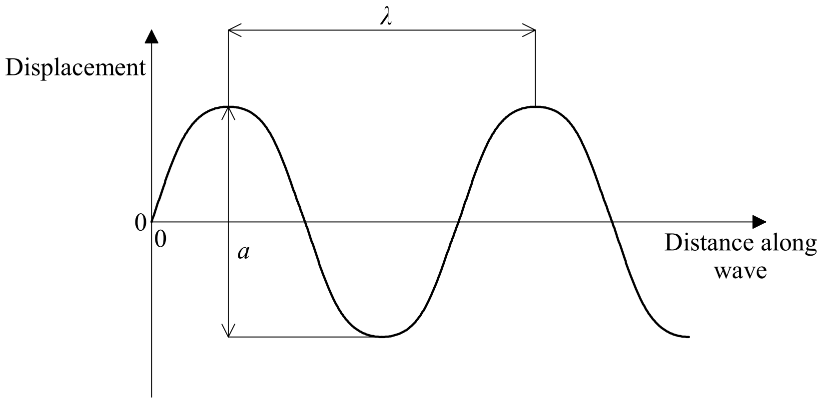

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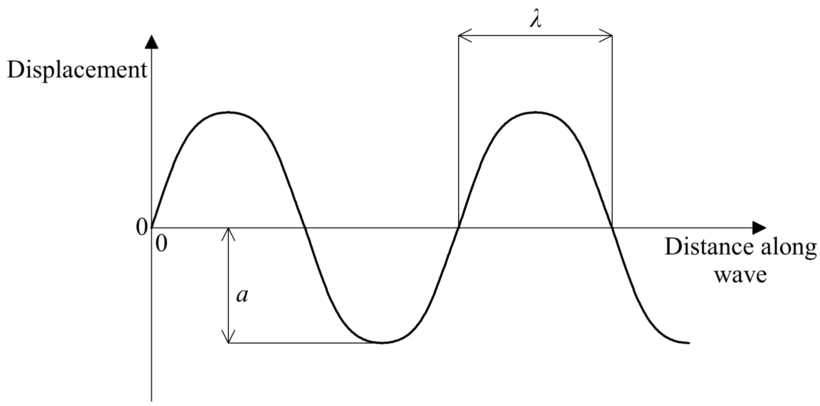

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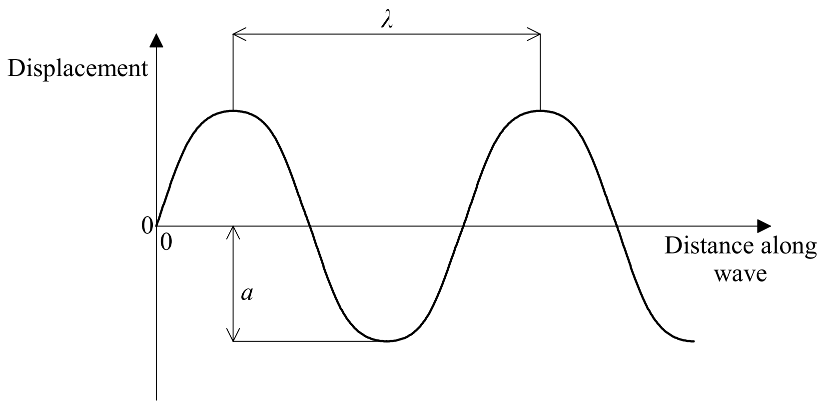


19. Standing waves in an open pipe come about as a result of

A. reflection and superposition.

B. reflection and diffraction.

C. superposition and diffraction.

D. reflection and refraction.

20. A source of sound approaches a stationary observer. The Doppler effect may be described by the observer as

A. the increase in loudness of the sound.

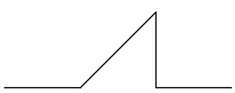
B. the increase in wavelength of the sound.

C. the increase in frequency of the sound.

D. the increase in relative speed of the sound waves.

21. The diagram below shows two wave pulses moving towards one another.

Which **one** of the following diagrams shows the resultant pulse when the two pulses are superposed?

A.


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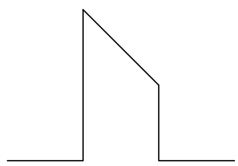

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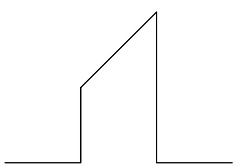

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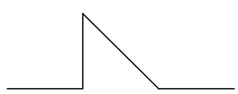
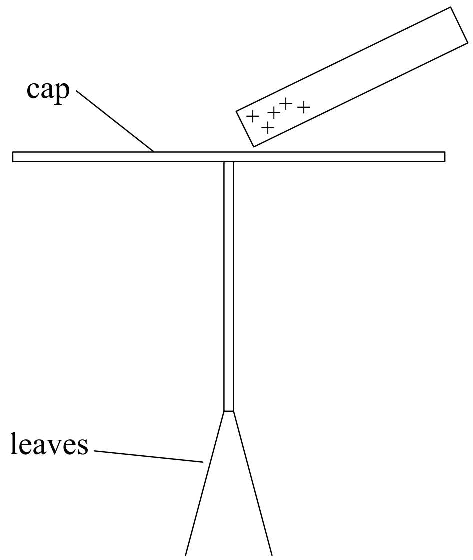


22. A gold leaf electroscope is initially uncharged. A positively charged rod is now held near the cap of the electroscope, as shown below.



Which **one** of the following statements is true?

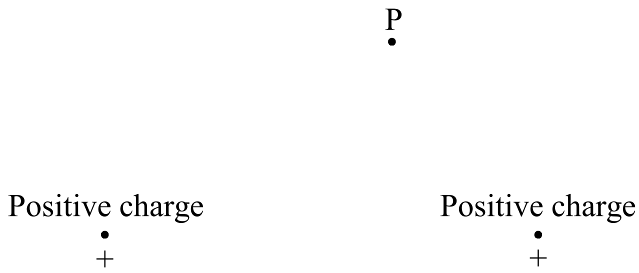
A. The cap is negatively charged and the leaves positively charged.

B. The cap is positively charged and the leaves negatively charged.

C. The cap is negatively charged and the leaves remain uncharged.

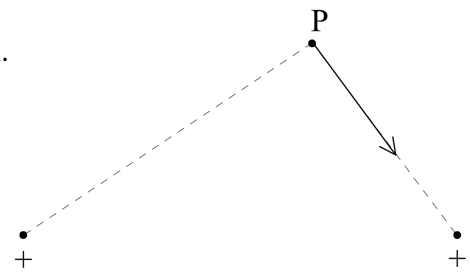
D. The cap is positively charged and the leaves remain uncharged.

23. The diagram below shows two positive point charges of equal magnitude. A negative point charge is placed at P.

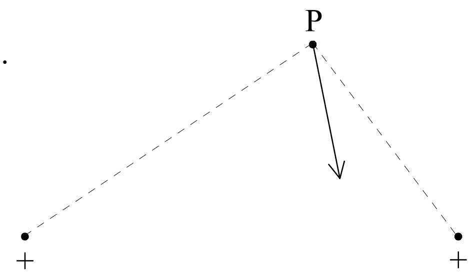


Which **one** of the following diagrams best shows the direction of the resultant force on the negative charge at P?

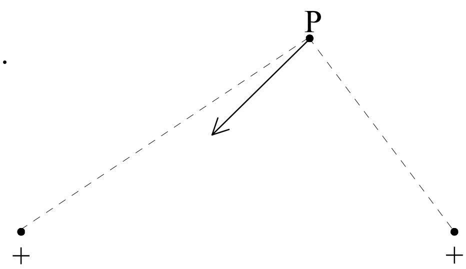
A.



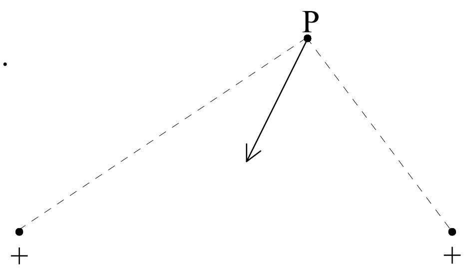
B.



C.



D.



24. Which **one** of the following is a fundamental unit?

A. Coulomb

B. Ohm

C. Volt

D. Ampere

25. A battery is connected in series with a resistor R. The battery transfers 2 000 C of charge completely round the circuit. During this process, 2 500 J of energy is dissipated in the resistor R and 1 500 J is expended in the battery.

The e.m.f. of the battery is

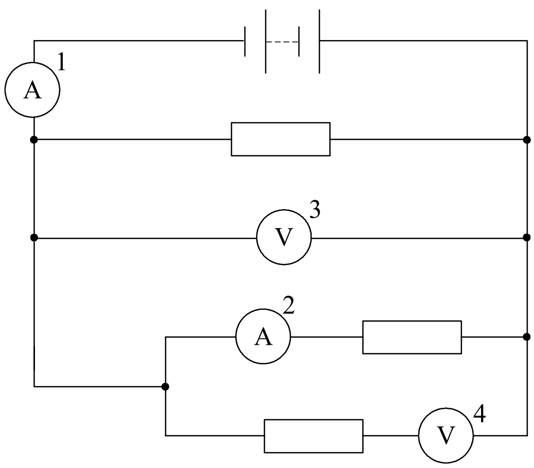
A. 2.00 V.

B. 1.25 V.

C. 0.75 V.

D. 0.50 V.

26. In the circuit below, which meter is **not** correctly connected?



A. 1

B. 2

C. 3

D. 4

27. A charged particle of mass m and charge q is travelling in a uniform magnetic field with speed v such that the magnetic force on the particle is F. The magnetic force on a particle of mass $2m$, charge q and speed $2v$ travelling in the same direction in the magnetic field is

A. $4F$.

B. $2F$.

C. F.

D. $\frac{1}{2}F$.

28. An isotope of radium has a half-life of 4 days. A freshly prepared sample of this isotope contains N atoms. The time taken for $\frac{7N}{8}$ of the atoms of this isotope to decay is

A. 32 days.

B. 16 days.

C. 12 days.

D. 8 days.

29. The presence of neutrons inside the nucleus is supported by the existence of

A. isotopes.

B. orbiting electrons.

C. gamma radiation.

D. neutral atoms.

30. The source of the Sun's energy is

A. fission.

B. radioactivity.

C. fusion.

D. ionization.