



**PHYSICS
STANDARD LEVEL
PAPER 1**

Monday 10 May 2010 (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.

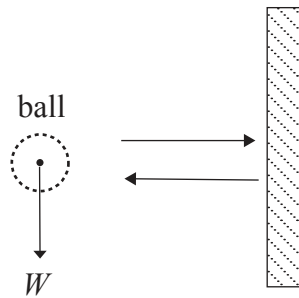
1. The best estimate for the time it takes light to cross the nucleus of the hydrogen atom is
 - A. 10^{-23} s.
 - B. 10^{-20} s.
 - C. 10^{-15} s.
 - D. 10^{-7} s.

2. The length of each side of a sugar cube is measured as 10 mm with an uncertainty of ± 2 mm. Which of the following is the absolute uncertainty in the volume of the sugar cube?
 - A. $\pm 6 \text{ mm}^3$
 - B. $\pm 8 \text{ mm}^3$
 - C. $\pm 400 \text{ mm}^3$
 - D. $\pm 600 \text{ mm}^3$

3. The time taken for a stone dropped from rest to fall vertically through 16 m is 2.0 s. Based on these measurements, what is the best estimate for the acceleration of free fall?
 - A. 4.0 m s^{-2}
 - B. 8.0 m s^{-2}
 - C. 9.8 m s^{-2}
 - D. 10 m s^{-2}

4. A wooden block is sliding down an inclined plane at constant speed. The magnitude of the frictional force between the block and the plane is equal to
 - A. zero.
 - B. the magnitude of the weight of the block.
 - C. the magnitude of the component of weight of the block parallel to the plane.
 - D. the magnitude of the component of the normal reaction parallel to the plane.

5. Which of the following is a correct statement of Newton’s second law of motion?
- A. A force acting on a body is proportional to the mass of the body.
 - B. The rate of change of momentum of a body is equal to the net external force acting on the body.
 - C. The momentum of a body is proportional to the net external force acting on the body.
 - D. A force acting on a body is proportional to the acceleration of the body.
6. A ball of weight W is travelling horizontally towards a vertical wall. It strikes the wall and rebounds horizontally. The change in the magnitude of the momentum of the ball is Δp . Which of the following is the magnitude of the impulse that the ball imparts to the wall?



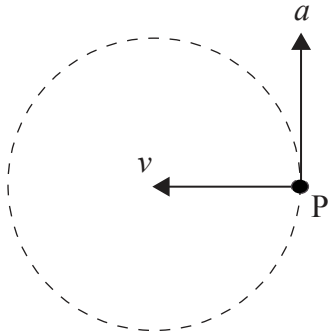
- A. $W + \Delta p$
 - B. $W - \Delta p$
 - C. W
 - D. Δp
7. Two objects undergo an inelastic collision. Which of the following is correct in respect of both the conservation of momentum and the conservation of total energy of the system?

	Momentum	Total energy
A.	conserved	not conserved
B.	conserved	conserved
C.	not conserved	not conserved
D.	not conserved	conserved

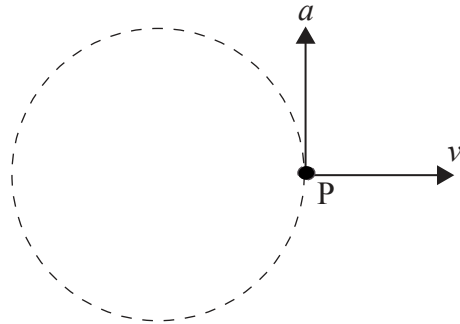
8. A particle P is moving anti-clockwise with constant speed in a horizontal circle.

Which diagram correctly shows the direction of the velocity v and acceleration a of the particle P in the position shown?

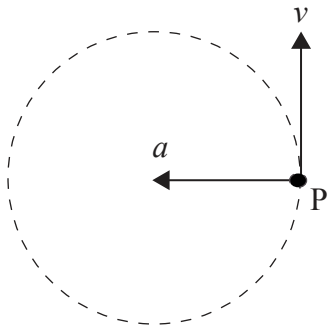
A.



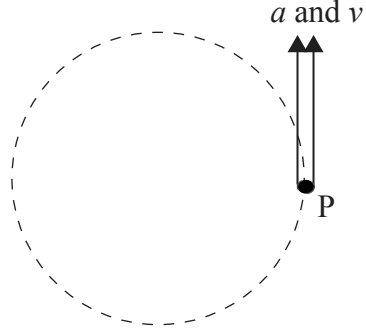
B.



C.



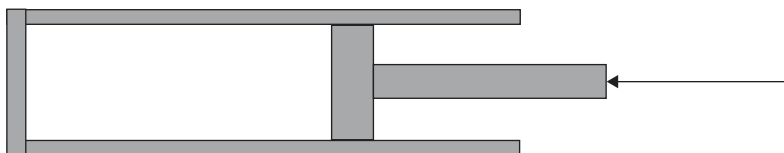
D.



9. Two objects are in thermal contact with each other. Which of the following will determine the direction of the transfer of thermal energy between the bodies?

- A. The mass of each body
- B. The area of contact between the bodies
- C. The specific heat capacity of each body
- D. The temperature of each body

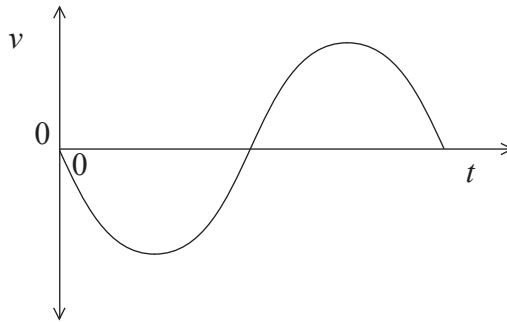
10. The mole is defined as
- A. $\frac{1}{12}$ the mass of an atom of the isotope carbon-12.
 - B. the amount of a substance that contains as many elementary entities as the number of atoms in 12 g of the isotope carbon-12.
 - C. the mass of one atom of the isotope carbon-12.
 - D. the amount of a substance that contains as many nuclei as the number of nuclei in 12 g of the isotope carbon-12.
11. A gas is contained in a cylinder by a piston.



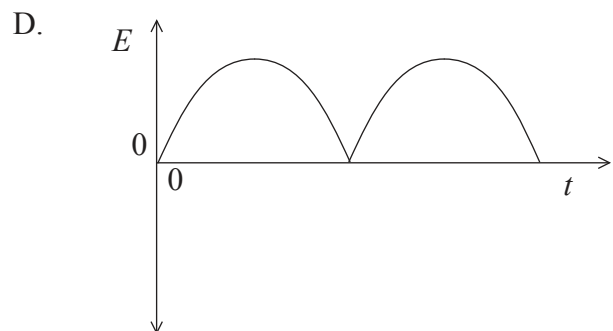
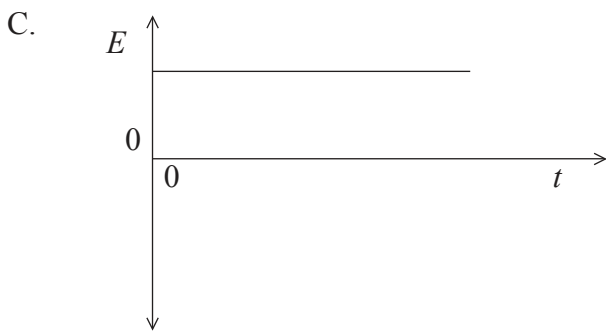
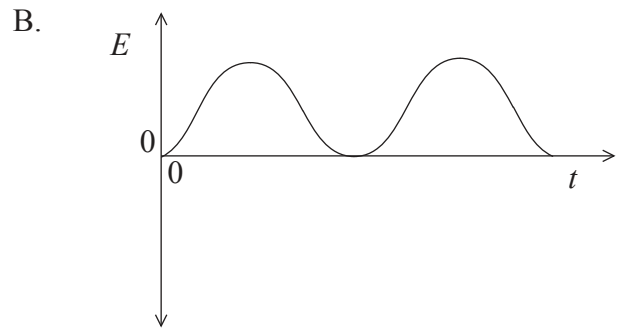
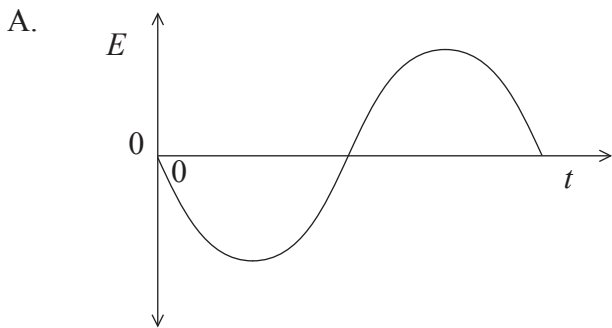
The gas is compressed rapidly by moving the piston in the direction shown. The best explanation for the resulting increase in temperature of the gas is that the molecules of the gas gain kinetic energy

- A. from the moving piston.
- B. by colliding more frequently with each other.
- C. by being pushed closer together.
- D. by colliding more frequently with the walls of the cylinder.

12. The graph shows how the velocity v of an object undergoing simple harmonic motion varies with time t for one complete period of oscillation.



Which of the following sketch graphs best shows how the total energy E of the object varies with t ?



13. A force that varies sinusoidally is applied to a system that is lightly damped. Which of the following must be true of the force for resonance to occur?
- A. It must always be in anti-phase with the oscillations of the system.
 - B. Its direction must always be in the direction of motion of the oscillations of the system.
 - C. Its frequency must be equal to the frequency of oscillation of the system.
 - D. Its amplitude must be equal to the amplitude of oscillation of the system.

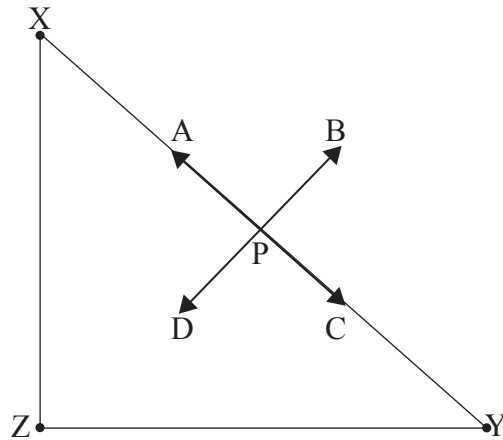
14. Which of the following is a value of wavelength that is found in the visible region of the electromagnetic spectrum?
- A. 4×10^{-5} m
 - B. 4×10^{-7} m
 - C. 4×10^{-9} m
 - D. 4×10^{-11} m
15. Two waves meet at a point in space. Which of the following properties always add together?
- A. Displacement
 - B. Amplitude
 - C. Speed
 - D. Frequency
16. A point charge of magnitude $2.0 \mu\text{C}$ is moved between two points X and Y. Point X is at a potential of $+6.0\text{V}$ and point Y is at a potential of $+9.0\text{V}$. The gain in potential energy of the point charge is
- A. $0.20 \mu\text{J}$.
 - B. $1.5 \mu\text{J}$.
 - C. $6.0 \mu\text{J}$.
 - D. $30 \mu\text{J}$.

17. A resistor of resistance $12\ \Omega$ is connected in series with a cell of negligible internal resistance. The power dissipated in the resistor is P . The resistor is replaced with a resistor of resistance $3.0\ \Omega$. What is the power dissipated in this resistor?
- A. $0.25P$
 - B. P
 - C. $2.0P$
 - D. $4.0P$
18. The electromotive force (emf) of a cell is defined as
- A. the power supplied by the cell per unit current from the cell.
 - B. the force that the cell provides to drive electrons round a circuit.
 - C. the energy supplied by the cell per unit current from the cell.
 - D. the potential difference across the terminals of the cell.
19. The weight of an object of mass $1\ \text{kg}$ at the surface of Mars is about $4\ \text{N}$. The radius of Mars is about half the radius of Earth. Which of the following is the best estimate of the ratio below?

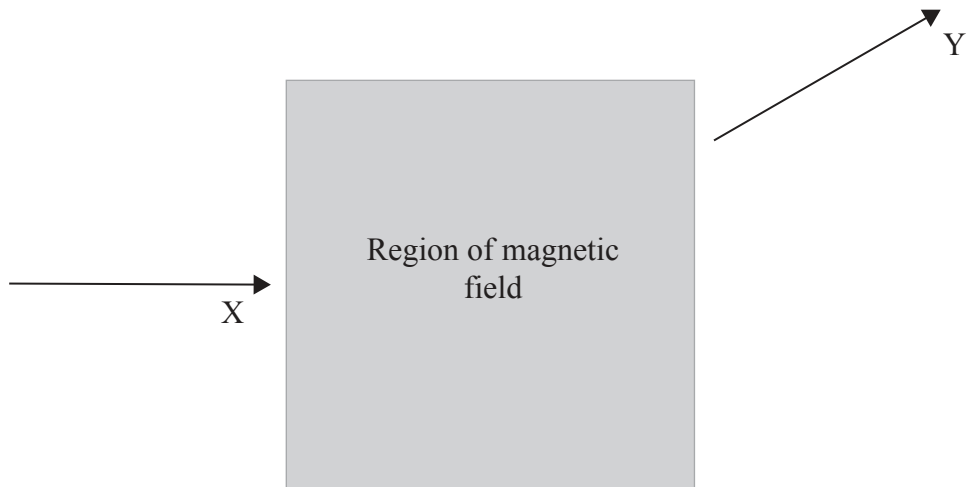
$$\frac{\text{mass of Mars}}{\text{mass of Earth}}$$

- A. 0.1
- B. 0.2
- C. 5
- D. 10

20. Three positive point charges of equal magnitude are held at the corners X, Y and Z of a right-angled triangle. The point P is at the midpoint of XY. Which of the arrows shows the direction of the electric field at point P?



21. An electron travelling in the direction shown by the arrow X, enters a region of uniform magnetic field. It leaves the region of field in the direction shown by the arrow Y.



The direction of the magnetic field is

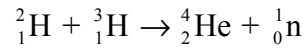
- A. in the direction of X.
- B. into the plane of the paper.
- C. in the opposite direction to X.
- D. out of the plane of the paper.

22. Emission and absorption spectra provide evidence for
- A. the nuclear model of the atom.
 - B. natural radioactivity.
 - C. the existence of isotopes.
 - D. the existence of atomic energy levels.
23. Which of the following is true in respect of both the Coulomb interaction and the strong interaction between nucleons in an atom?

	Coulomb interaction exists between	Strong interaction exists between
A.	protons only	neutrons only
B.	both protons and neutrons	neutrons only
C.	protons only	both protons and neutrons
D.	both protons and neutrons	both protons and neutrons

24. Which of the following correctly identifies the three particles emitted in the decay of the nucleus ${}_{20}^{45}\text{Ca}$ into a nucleus of ${}_{21}^{45}\text{Sc}$?
- A. α, β^-, γ
 - B. $\beta^-, \gamma, \bar{\nu}$
 - C. $\alpha, \gamma, \bar{\nu}$
 - D. $\alpha, \beta^-, \bar{\nu}$

25. The nuclear reaction



is an example of

- A. nuclear fission.
 - B. radioactive decay.
 - C. nuclear fusion.
 - D. artificial transmutation.
26. Degraded energy is energy that is
- A. stored in the Earth’s atmosphere.
 - B. available from non-renewable energy sources.
 - C. converted into work in a cyclical process.
 - D. no longer available for the performance of useful work.
27. Which of the following correctly describes both the role of the moderator and of the control rods in a nuclear reactor?

	Moderator	Control rods
A.	slows down the neutrons	maintain a constant rate of fission
B.	cools down the reactor	extract thermal energy
C.	cools down the reactor	maintain a constant rate of fission
D.	slows down the neutrons	extract thermal energy

28. Which of the following correctly shows the energy change in a photovoltaic cell and in a solar heating panel?

	Photovoltaic cell	Solar heating panel
A.	solar → electrical	solar → thermal
B.	electrical → thermal	solar → electrical
C.	solar → electrical	electrical → thermal
D.	electrical → thermal	solar → thermal

29. The albedo for the oceans is lower than that for glaciers. This is because, compared to ice, sea water

- A. has a greater density.
- B. has a greater specific heat capacity.
- C. has a greater coefficient of volume expansion.
- D. absorbs a greater amount of radiative power.

30. Which of the following is most likely to reduce the enhanced greenhouse effect?

- A. Replace the use of gas powered stations with oil powered stations
- B. Replace coal-fired power stations with nuclear power stations
- C. Increase the use of all non-renewable energy sources
- D. Decrease the efficiency of power production