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**PHYSICS  
STANDARD LEVEL  
PAPER 1**

Wednesday 7 May 2014 (morning)

45 minutes

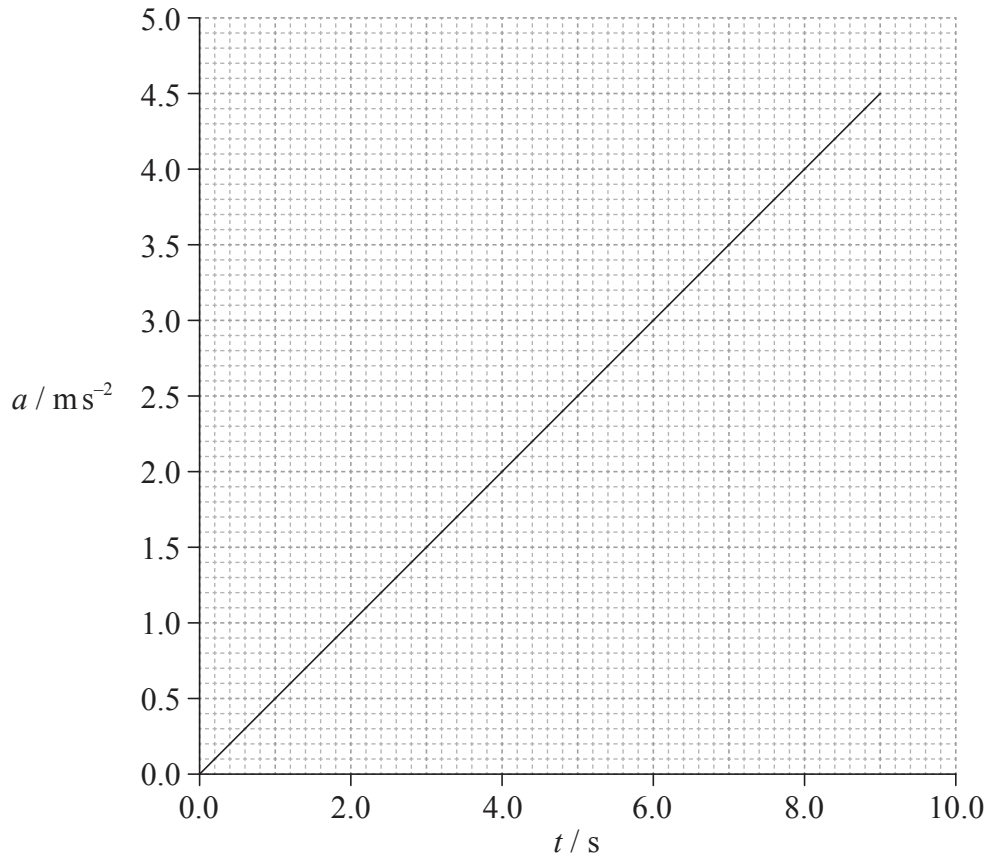
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**INSTRUCTIONS TO CANDIDATES**

- 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.
- A clean copy of the **Physics Data Booklet** is required for this paper.
- The maximum mark for this examination paper is [30 marks].

1. Which of the following is a unit of energy?
  - A.  $\text{kg m}^{-1} \text{s}^{-1}$
  - B.  $\text{kg m}^2 \text{s}^{-2}$
  - C.  $\text{kg m s}^{-2}$
  - D.  $\text{kg m}^2 \text{s}^{-1}$
  
2. Each side of a metal cube is measured to be  $2.0 \text{ cm} \pm 0.20 \text{ cm}$ . What is the absolute uncertainty in the calculated volume of the cube?
  - A.  $\pm 0.08 \text{ cm}^3$
  - B.  $\pm 0.60 \text{ cm}^3$
  - C.  $\pm 0.80 \text{ cm}^3$
  - D.  $\pm 2.4 \text{ cm}^3$

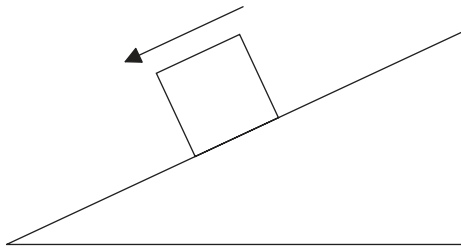
3. A particle accelerates from rest. The graph shows how the acceleration  $a$  of the particle varies with time  $t$ .



What is the speed of the particle at  $t=6.0 \text{ s}$ ?

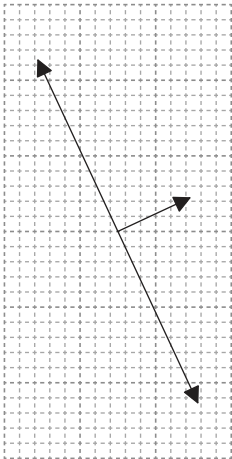
- A.  $0.5 \text{ ms}^{-1}$
- B.  $2.0 \text{ ms}^{-1}$
- C.  $9.0 \text{ ms}^{-1}$
- D.  $18 \text{ ms}^{-1}$

4. A block slides down an inclined plane at constant speed.

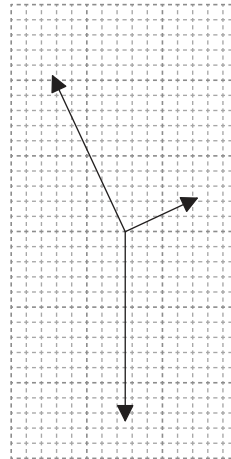


Which diagram represents the free-body diagram of the forces acting on the block?

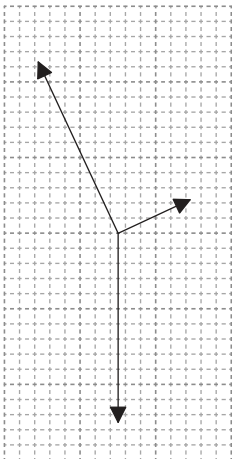
A.



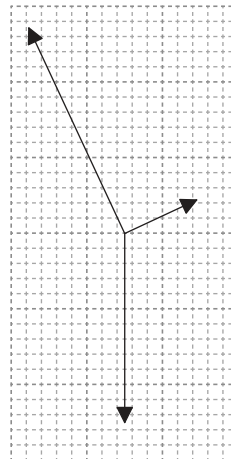
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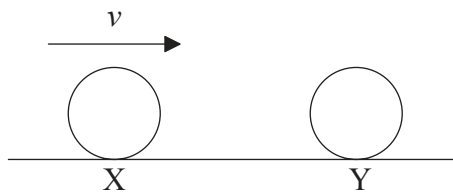


D.



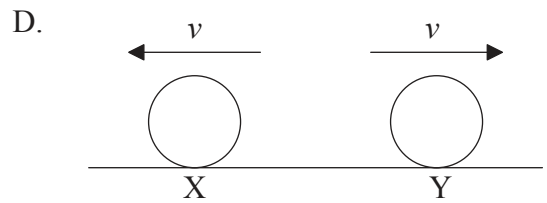
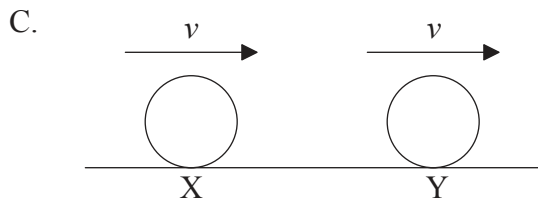
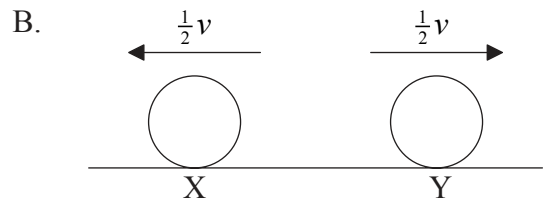
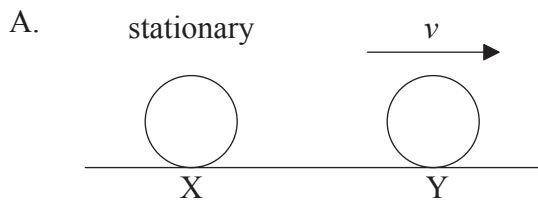
5. In the collision between two bodies, Newton's third law
- A. only applies if momentum is conserved in the collision.
  - B. only applies if energy is conserved in the collision.
  - C. only applies if both momentum and energy are conserved in the collision.
  - D. always applies.

6. A ball X moving horizontally collides with an identical ball Y that is at rest.

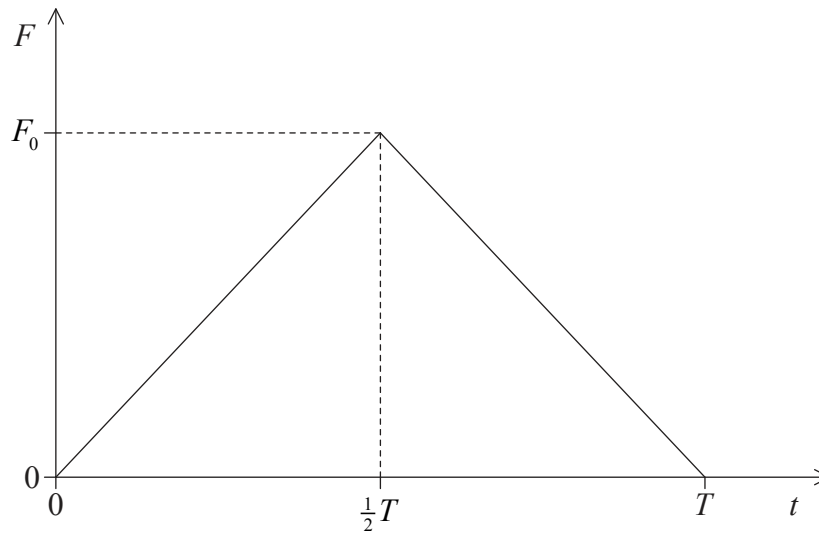


X strikes Y with speed  $v$ .

What is a possible outcome of the collision?



7. A ball is moving horizontally and strikes a vertical wall from which it rebounds horizontally. The sketch graph shows how the contact force  $F$  between ball and wall varies with time of contact  $t$ .

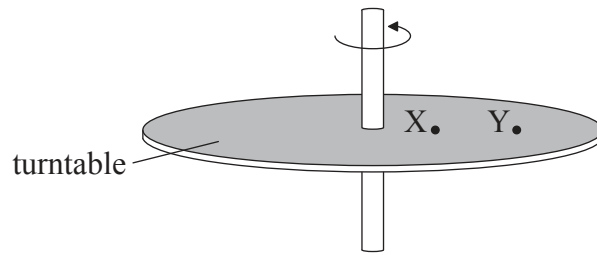


The maximum value of  $F$  is  $F_0$  and the total time of contact between ball and wall is  $T$ .

What is the change in momentum of the ball?

- A.  $\frac{F_0 T}{2}$
- B.  $F_0 T$
- C.  $\frac{F_0}{2T}$
- D.  $\frac{F_0}{T}$
8. An insect of mass  $m$  jumps vertically from rest to a height  $h$ . The insect releases the energy needed for the jump in time  $\Delta t$ . What is the estimate for the power developed by the insect?
- A.  $mgh \Delta t$
- B.  $mh \Delta t$
- C.  $\frac{mgh}{\Delta t}$
- D.  $\frac{mh}{\Delta t}$

9. Two particles, X and Y, are attached to the surface of a horizontally mounted turntable.

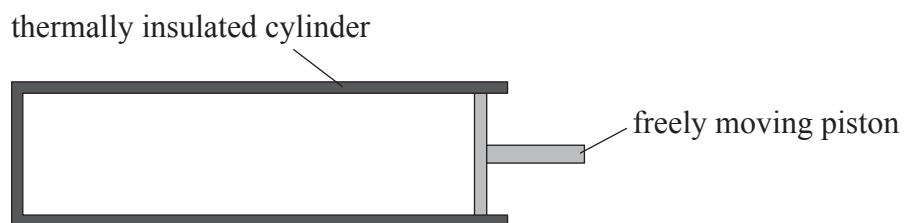


The turntable rotates uniformly about a vertical axis. The magnitude of the linear velocity of X is  $v$  and the magnitude of its acceleration is  $a$ . Which of the following correctly compares the magnitude of the velocity of Y and the magnitude of the acceleration of Y with  $v$  and  $a$  respectively?

	Magnitude of velocity of Y	Magnitude of acceleration of Y
A.	equal to $v$	less than $a$
B.	greater than $v$	less than $a$
C.	equal to $v$	greater than $a$
D.	greater than $v$	greater than $a$

10. Two objects are in thermal contact. For there to be no net transfer of thermal energy between the objects they must
- A. have the same thermal capacity and be at the same temperature.
  - B. have the same thermal capacity only.
  - C. have the same mass and be at the same temperature.
  - D. be at the same temperature only.

11. The specific latent heat is the energy required to change the phase of
- A. one kilogram of a substance.
  - B. a substance at constant temperature.
  - C. a liquid at constant temperature.
  - D. one kilogram of a substance at constant temperature.
12. An ideal gas is contained in a thermally insulated cylinder by a freely moving piston.

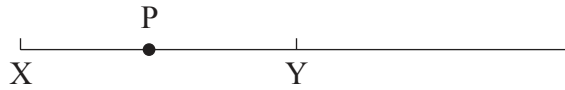


The gas is compressed by the piston and as a result the temperature of the gas increases. What is the explanation for the temperature rise?

- A. The rate of collision between the molecules increases.
- B. Energy is transferred to the molecules by the moving piston.
- C. The molecules of the gas are pushed closer together.
- D. The rate of collision between the molecules and the walls of the cylinder increases.



13. A particle P executes simple harmonic motion (SHM) about its equilibrium position Y.



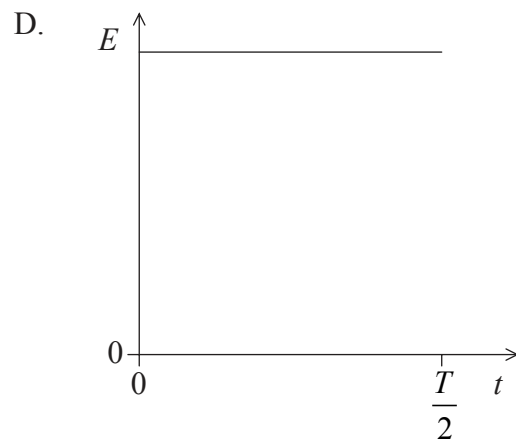
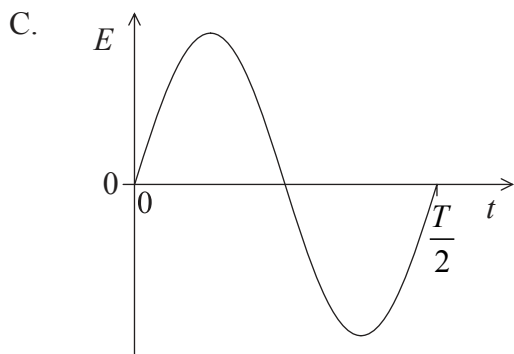
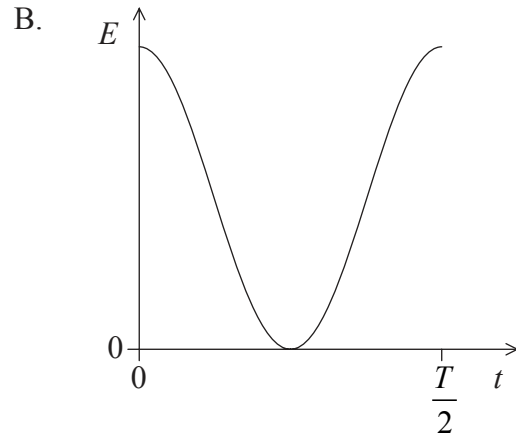
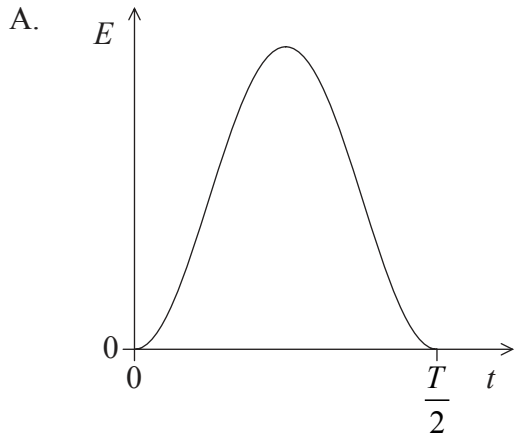
The amplitude of the motion is XY.

At which of the positions shown on the diagram is the acceleration of P equal to zero and the kinetic energy of P equal to zero?

	<b>Acceleration</b>	<b>Kinetic energy</b>
A.	Y	X
B.	X	X
C.	Y	Y
D.	X	Y

14. A particle executes simple harmonic motion (SHM) with period  $T$ .

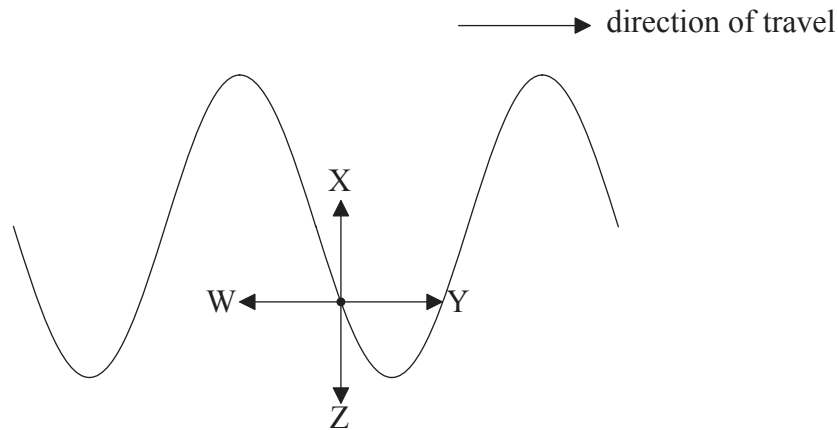
Which sketch graph correctly shows how the total energy  $E$  of the particle varies with time  $t$  from  $t=0$  to  $t=\frac{T}{2}$ ?



15. In which of the following systems is it desirable that damping should be as small as possible?

- A. Suspension bridge
- B. Quartz oscillator
- C. Car suspension
- D. Airplane/aeroplane wing

16. The diagram shows, at a particular instant in time, part of a rope along which a wave is travelling.

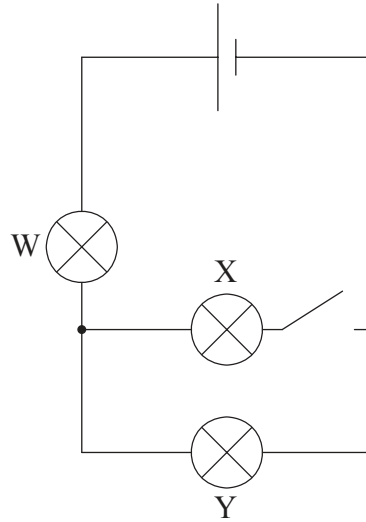


The wave is travelling from left to right.

Which arrow shows the direction of motion of the rope at the point shown?

- A. W
  - B. X
  - C. Y
  - D. Z
17. Which of the following is a statement of Ohm's law?
- A. The resistance of a conductor is constant.
  - B. The current in a conductor is inversely proportional to the potential difference across the conductor provided the temperature is constant.
  - C. The resistance of a conductor is constant provided that the temperature is constant.
  - D. The current in a conductor is proportional to the potential difference across it.

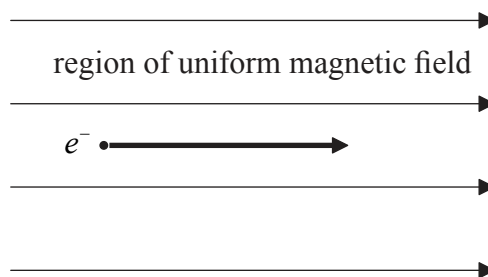
18. Three identical filament lamps W, X and Y are connected in the circuit as shown. The cell has negligible internal resistance.



When the switch is closed, all the lamps light. Which of the following correctly describes what happens to the brightness of lamp W and lamp Y when the switch is opened?

	Lamp W	Lamp Y
A.	decreases	decreases
B.	increases	decreases
C.	decreases	increases
D.	increases	increases

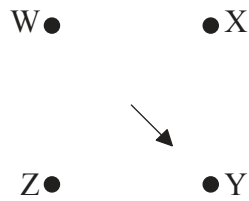
19. An electron is travelling in a region of uniform magnetic field. At the instant shown, the electron is moving parallel to the field direction.



The magnetic force on the electron is

- A. upwards.
  - B. downwards.
  - C. to the right.
  - D. zero.
20. The gravitational field strength at a point X in a gravitational field is defined as the force
- A. per unit mass on a mass placed at X.
  - B. on a mass placed at X.
  - C. per unit mass on a small point mass placed at X.
  - D. on a small point mass placed at X.

21. Four point charges of equal magnitude W, X, Y and Z are each fixed to a corner of a square.



W is a positive charge and X is a negative charge. The arrow shows the direction of the resultant electric field at the centre of the square. What are the correct signs of charge Y and of charge Z?

	Y	Z
A.	positive	positive
B.	negative	positive
C.	positive	negative
D.	negative	negative

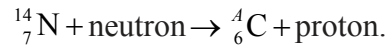
22. Which of the following provides evidence for the existence of atomic energy levels?

- A. Absorption spectra
- B. Nuclear fission
- C. The Geiger–Marsden experiment
- D. Radioactive decay

23. What is the definition of the unified atomic mass unit?

- A. The mass of one atom of hydrogen.
- B.  $\frac{1}{12}$  of the mass of an atom of carbon-12.
- C. The mass of one atom of carbon-12.
- D.  $\frac{1}{16}$  of the mass of an atom of oxygen-16.

24. Nuclei of the isotope nitrogen-14 are bombarded with neutrons and as a result nuclei of an isotope of carbon are produced. The nuclear reaction equation for this process may be written as



What is the nucleon number  $A$  of the isotope of carbon?

- A. 12
- B. 13
- C. 14
- D. 15
25. Degraded energy is energy that is
- A. produced by the combustion of fossil fuels.
- B. no longer available to perform useful work.
- C. produced by low-energy density fuels.
- D. relatively cheap to produce.
26. A black body has absolute temperature  $T$  and surface area  $A$ . The intensity of the radiation emitted by the body is  $I$ . Another black body of surface area  $2A$  has absolute temperature  $2T$ . What is the intensity of radiation emitted by this second black body?
- A.  $4I$
- B.  $8I$
- C.  $16I$
- D.  $32I$

27. In the production of energy from nuclear fission, fuel enrichment means increasing, in the fuel rods, the amount of
- A. uranium-238.
  - B. plutonium-239.
  - C. uranium-235.
  - D. uranium-235 and plutonium-239.
28. In a wind generator, the kinetic energy of the wind cannot be completely converted into mechanical kinetic energy. This is because
- A. momentum is not conserved in the collisions between air molecules and the blades.
  - B. the density of the air depends on the temperature of the air.
  - C. the air molecules cannot be brought completely to rest in collisions with the blades.
  - D. the wind speed does not remain constant.
29. The greenhouse effect can be explained by the fact that the infrared radiation emitted by the surface of Earth
- A. is absorbed by the atmosphere and then re-radiated in all directions.
  - B. raises the temperature of the upper atmosphere.
  - C. is trapped by the upper atmosphere.
  - D. is absorbed by the atmosphere and then all of it is re-radiated back to the surface of Earth.
30. Which of the following mechanisms will **not** increase the rate of global warming?
- A. The reduction in area of the ozone layer
  - B. The reduction of carbon dioxide solubility in the oceans
  - C. Deforestation
  - D. The melting of snow and ice at the poles
-