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22096516

PHYSICS
STANDARD LEVEL
PAPER 1

Tuesday 12 May 2009 (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.

22096516

1. The magnitude of the mass of the universe is of the order of

A. 10^{20} kg.

B. 10^{30} kg.

C. 10^{40} kg.

D. 10^{50} kg.

2. Which of the following is a valid statement?

A. A measurement that is not precise can be accurate.

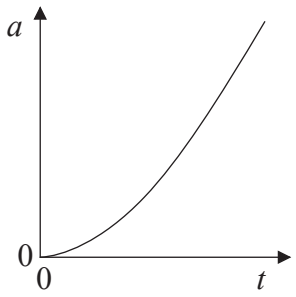
B. A measurement that is precise is always accurate.

C. A measurement that is not precise will always be inaccurate.

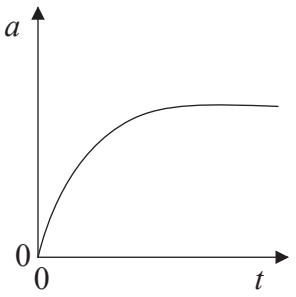
D. Repeated measurements will always increase accuracy and precision.

3. A ball, initially at rest, is dropped in the air from a great height. Air resistance is not negligible. Which of the following graphs best shows the variation with time t of the acceleration a of the ball?

A.



B.



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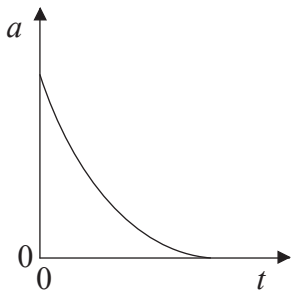
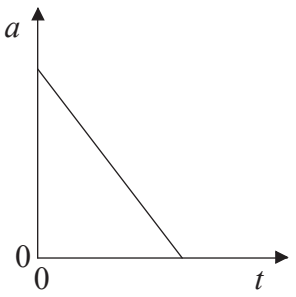
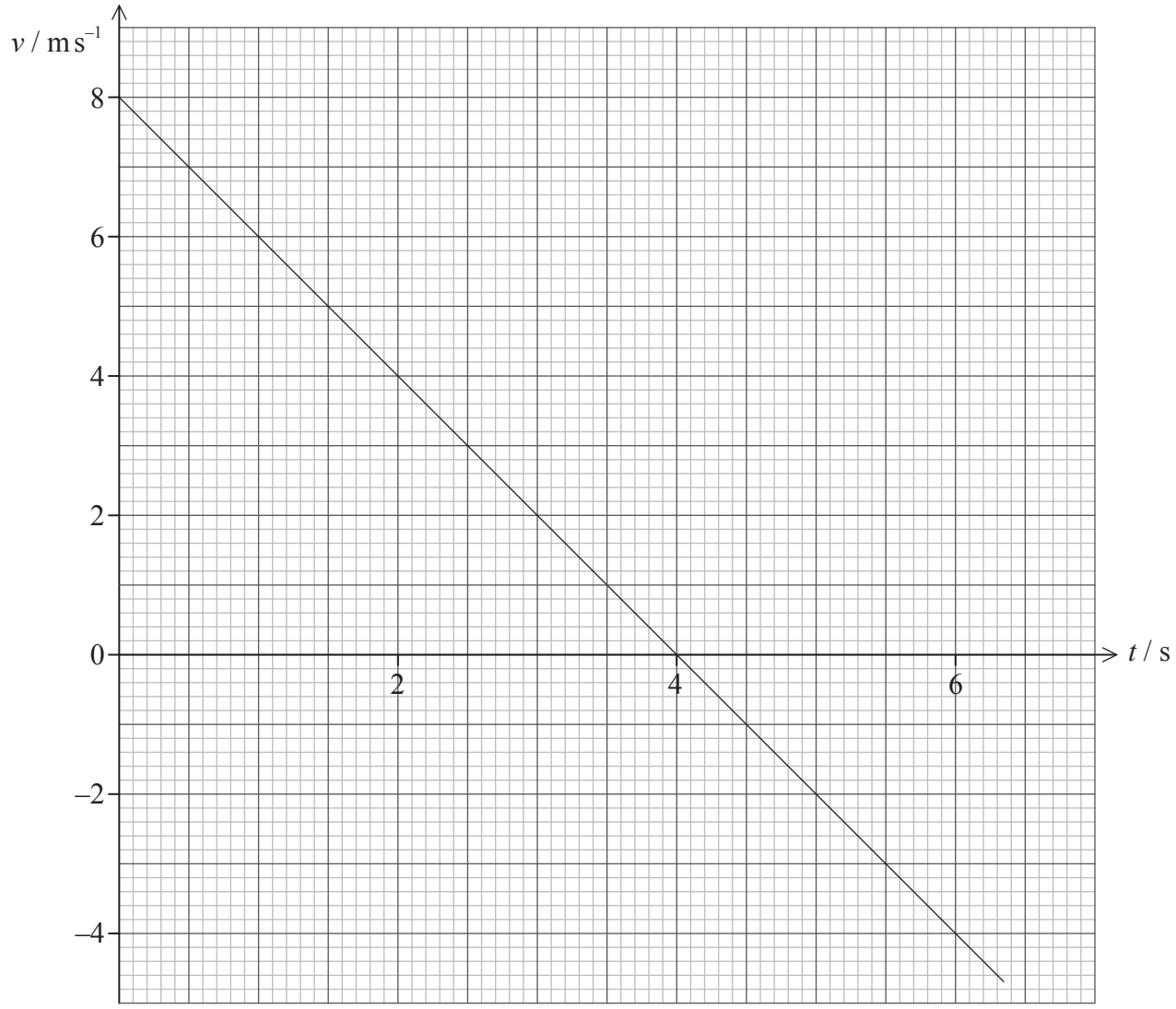


D.



4. The graph below shows the variation with time t of the velocity v of an object moving along a straight line.



The displacement of the object between $t = 0\,\text{s}$ and $t = 6.0\,\text{s}$ is

A. 2.0 m.

B. 12 m.

C. 20 m.

D. 24 m.

5. A constant force of magnitude F is applied to a mass m for a time interval Δt. The magnitude of the impulse given to the mass equals

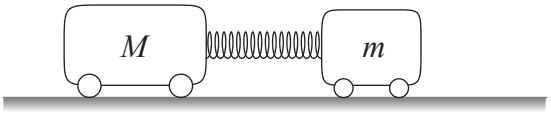
A. $\frac{F}{m}$.

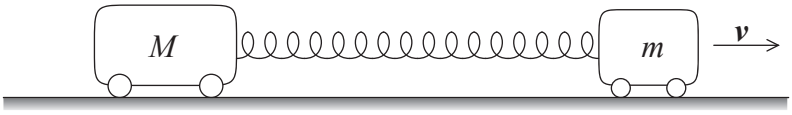
B. $\frac{F}{\Delta t}$.

C. $F\Delta t$.

D. $\frac{F\Delta t}{m}$.

6. Two carts of different mass m and M are connected by a spring. They are pushed together such that the spring is compressed.





After the carts are released, the cart of mass m moves with velocity $\boldsymbol{v}$. The change in the momentum of mass M is

A. $m\boldsymbol{v}$.

B. $-m\boldsymbol{v}$.

C. $M\boldsymbol{v}$.

D. $-M\boldsymbol{v}$.

7. A lamp of weight W is suspended by a wire fixed to the ceiling. With reference to Newton's third law of motion, the force that is equal and opposite to W is the

A. tension in the wire.

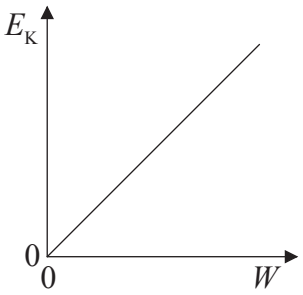
B. force applied by the ceiling.

C. force exerted by the lamp on the Earth.

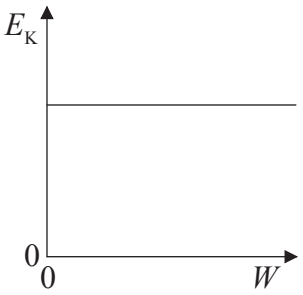
D. force exerted by the Earth on the lamp.

8. A constant force acts on a mass that is initially at rest. Which of the following graphs best shows how the kinetic energy E_K of the mass changes with the work W done on the mass? Friction is negligible.

A.



B.



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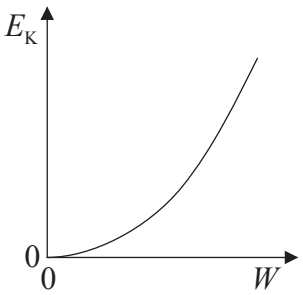

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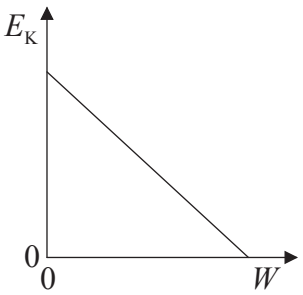


9. Two objects near each other are at the same temperature. Which of the following statements has to be true?

A. The objects have the same internal energy.

B. The objects have the same thermal capacity.

C. No thermal energy is exchanged between the objects.

D. The net thermal energy exchanged between the objects is zero.

10. The temperature of an ideal gas is a measure of the molecules' average

A. velocity.

B. momentum.

C. kinetic energy.

D. frequency of collisions.

11. For a system executing simple harmonic motion, the restoring force acting on the system is proportional to the

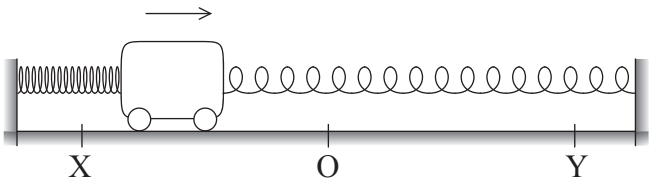
A. displacement of the system from equilibrium.

B. amplitude of oscillation.

C. elastic potential energy.

D. frequency of oscillation.

12. A cart, connected to two identical springs, is oscillating with simple harmonic motion between two points X and Y that are equidistant from point O.



The cart is in equilibrium at

A. all points between X and Y.

B. point O only.

C. points X and Y only.

D. points O, X and Y only.

13. During one complete oscillation, the amplitude of a **damped** harmonic motion changes from 1.5 cm to 0.30 cm. The total energy at the end of the oscillation is E_2 and the total energy at the beginning of the oscillation is E_1. The ratio $\frac{E_2}{E_1}$ is

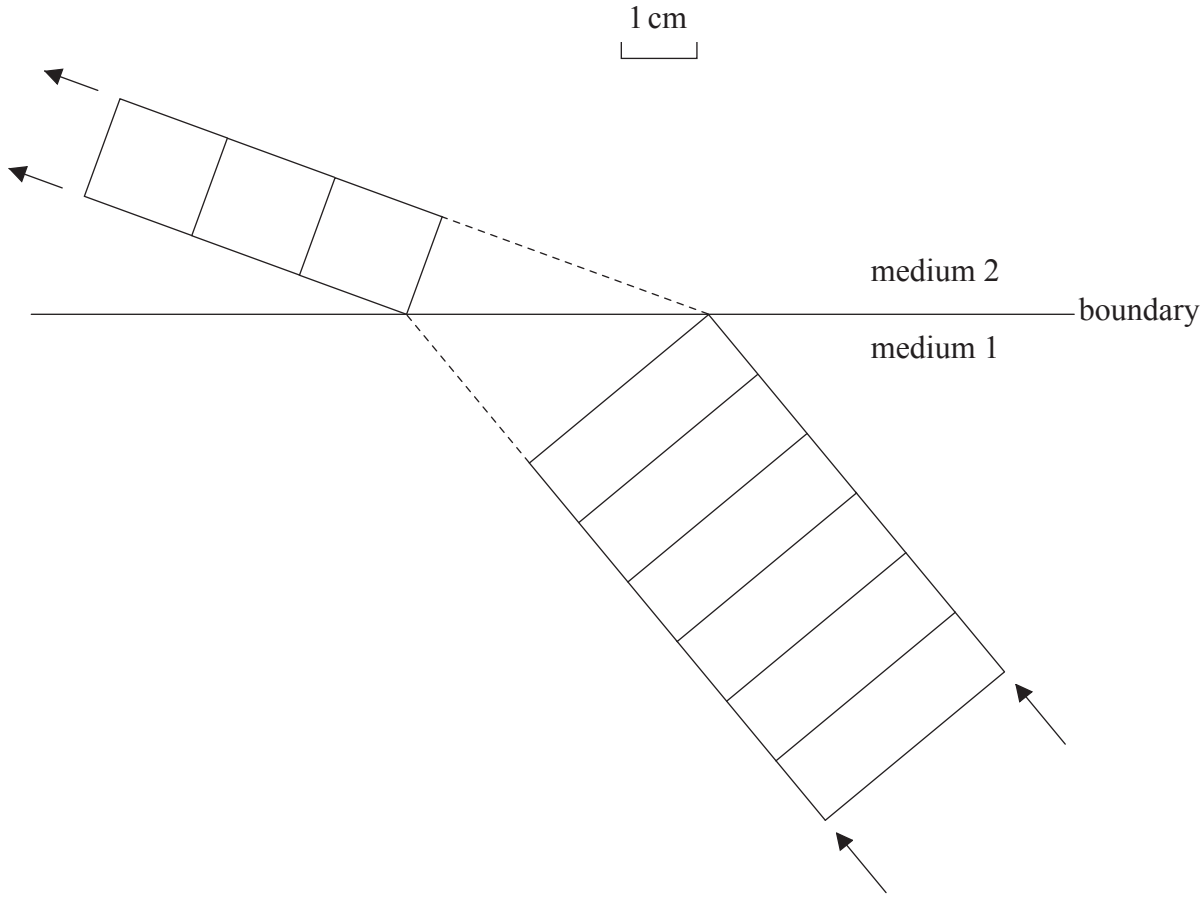
A. $\frac{1}{5}$.

B. $\frac{1}{25}$.

C. 5.

D. 25.

14. Plane wavefronts are incident on a boundary between two media labelled 1 and 2 in the diagram. The diagram of the wavefronts is drawn to scale.



The ratio of the refractive index of medium 2 to that of medium 1 is

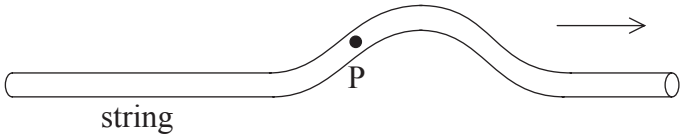
A. 0.50.

B. 0.67.

C. 1.5.

D. 2.0.

15. A wave pulse is travelling to the right along a string.



Which of the following best represents the direction of the velocity of the point P?

A. ↑

B. ↓

C. →

D. ←

16. The tungsten filament of a lamp has a cross-sectional area A and length L. For a potential difference V across the filament, the current in the filament is I. The resistivity of the tungsten equals

A. $\frac{VA}{IL}$.

B. $\frac{IL}{VA}$.

C. $\frac{VL}{IA}$.

D. $\frac{IA}{VL}$.

17. Which of the following is a correct unit of electromotive force (emf)?

A. $\mathrm{A\,\Omega^{-1}}$

B. $\mathrm{\Omega\,A^{-1}}$

C. $\mathrm{C\,J^{-1}}$

D. $\mathrm{J\,C^{-1}}$

18. Which of the following correctly gives the resistance of an ideal ammeter and resistance of an ideal voltmeter?

	Ammeter	Voltmeter
A.	infinite	infinite
B.	zero	zero
C.	zero	infinite
D.	infinite	zero

19. The gravitational force between two unit masses separated by a distance r is F_g. The electric force between two unit charges separated by a distance r is F_e. The Coulomb constant is k and the universal gravitational constant is G. The ratio F_g / F_e is

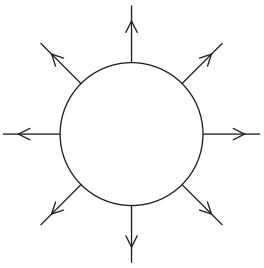
A. one.

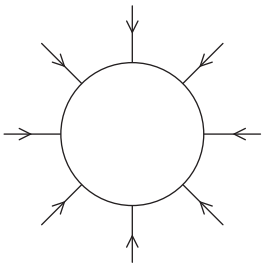
B. $\frac{k}{G}$.

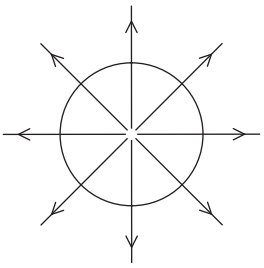
C. $\frac{G}{k}$.

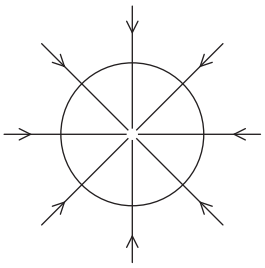
D. Gk.

20. A hollow metallic sphere is negatively charged. Which of the following correctly represents the electric field?

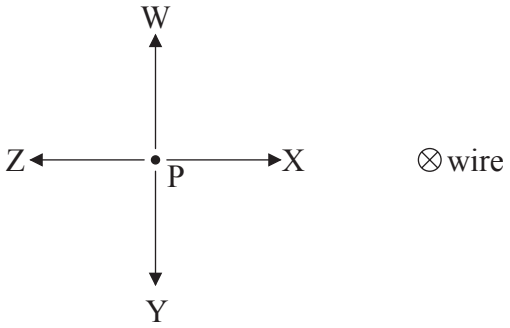
A. 

B. 

C. 

D. 

21. In the diagram, a long current-carrying wire is normal to the plane of the paper. The current in the wire ⊗ is directed into the plane of the paper.



Which of the arrows gives the direction of the magnetic field at point P?

A. W

B. X

C. Y

D. Z

22. The Geiger-Marsden experiment (scattering of alpha particles) provided evidence for

A. the nature of alpha particles.

B. orbital electrons in the atom.

C. very small and relatively massive nucleus.

D. the existence of atomic energy levels.

23. A nuclear reaction is represented by the following equation.

$$^{1}_{0}\mathrm{n} + {}^{198}_{80}\mathrm{Hg} \rightarrow {}^{197}_{79}\mathrm{Au} + {}^{2}_{1}\mathrm{H}$$

This reaction is an example of

A. fission.

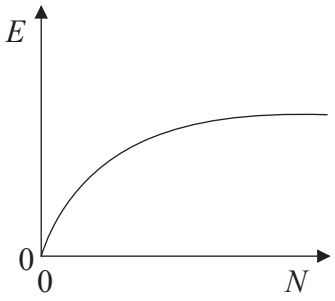
B. fusion.

C. natural transmutation.

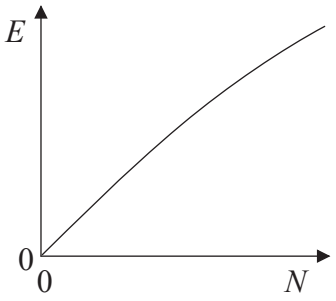
D. artificial (induced) transmutation.

24. Which of the following graphs best shows the variation with nucleon number N of the binding energy per nucleon E?

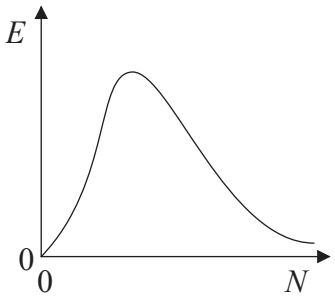
A.



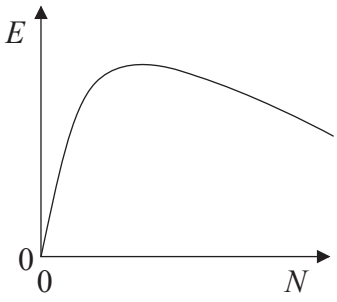
B.



C.



D.



25. The unit of energy density of a fuel is

A. $J\,m^{-2}$.

B. $J\,m^{-3}$.

C. $J\,kg^{-1}$.

D. $kg\,J^{-1}$.

26. Which of the following is the best estimate for the overall efficiency of a typical coal power station?

A. 5 %

B. 30 %

C. 60 %

D. 90 %

27. When sunlight is incident on a solar cell an electric current is produced. This is due to

A. a temperature gradient within the cell.

B. very long wavelength infrared radiation.

C. very short ultraviolet radiation.

D. the photoelectric effect.

28. The power per unit length P of an oscillating water column (OWC) is due to the action of a surface wave of amplitude A. Which of the following correctly relates P and A, and correctly identifies the nature of the energy of the water column?

	Relation between P and A	**Nature of energy**
A.	$P \propto A$	kinetic
B.	$P \propto A$	kinetic and potential
C.	$P \propto A^2$	kinetic
D.	$P \propto A^2$	kinetic and potential

29. The average temperature of the surface of the Sun is about 20 times more than the average surface temperature of the Earth. The average power per unit area radiated by the Earth is P. The average power per unit area radiated by the Sun is

A. 20 P.

B. 400 P.

C. 8000 P.

D. 160 000 P.

30. Global warming reduces the ice and snow cover on Earth. Which of the following correctly describes the changes in albedo and rate of energy absorption by Earth?

	Albedo	**Rate of energy absorption**
A.	increase	increase
B.	decrease	increase
C.	increase	decrease
D.	decrease	decrease