N08/4/PHYSI/SPM/ENG/TZ0/XX

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PHYSICS
STANDARD LEVEL
PAPER 1

Tuesday 4 November 2008 (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 diameter of a proton is of the order of which of the following?

A. 10^{-12} m

B. 10^{-13} m

C. 10^{-14} m

D. 10^{-15} m

2. Which of the following is a list of fundamental units only?

A. kilogram, mole, kelvin

B. kilogram, coulomb, kelvin

C. ampere, mole, centigrade

D. coulomb, mole, celsius

3. The speed of sound v in a gas is related to the pressure p and density D of the gas by the formula

$$v = \sqrt{\frac{\gamma p}{D}}$$

where γ is a constant.

The speed v is measured at constant density for different values of pressure p. Which of the following graphs should produce a straight line?

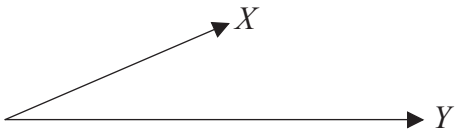
A. v against p

B. v^2 against p

C. $\sqrt{v}$ against γp

D. v against $\frac{p}{D}$

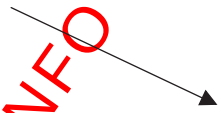
4. The magnitude and direction of two vectors X and Y are represented by the vector diagram below.



Which of the following best represents the vector $(X–Y)$?

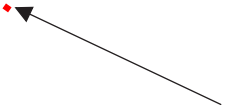
A.

B.

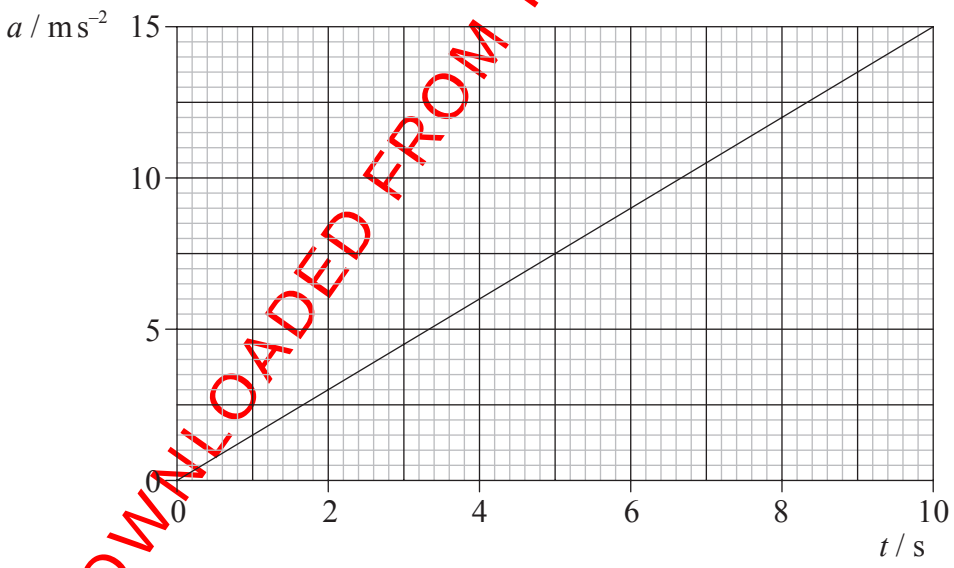


C.

D.



5. The graph shows the variation with time t of the acceleration a of a body that starts from rest at $t=0$.



Which of the following is the speed of the object after 10 s?

A. $0.67\,\text{m s}^{-1}$

B. $1.5\,\text{m s}^{-1}$

C. $75\,\text{m s}^{-1}$

D. $150\,\text{m s}^{-1}$

6. Which of the following is the definition of instantaneous velocity at a given time t?

A. $\frac{\text{distance travelled}}{t}$

B. The rate of change of distance travelled at t

C. $\frac{\text{displacement}}{t}$

D. The rate of change of displacement at t

7. A feather is dropped from rest at a height of 9.0 m above the surface of the Moon. It takes 3.0 s to reach the surface. Based on this observation, which of the following is the best estimate of the acceleration of free fall at the surface of the Moon?

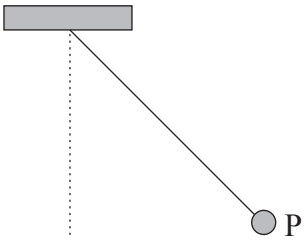
A. $0.50\,\text{m s}^{-2}$

B. $1.0\,\text{m s}^{-2}$

C. $2.0\,\text{m s}^{-2}$

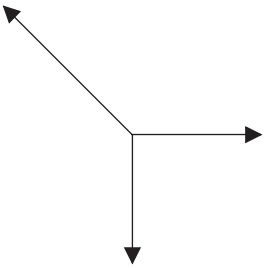
D. $3.0\,\text{m s}^{-2}$

8. A small object P is suspended by a vertical light string. It is then pulled to one side by a force equal in magnitude to the weight of the object and held stationary in the position shown below.

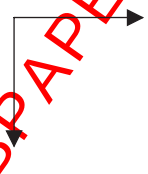


Which of the following is the correct free-body diagram for the forces acting on P in the position shown above?

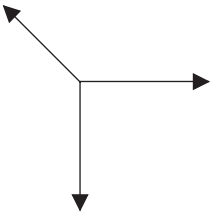
A.



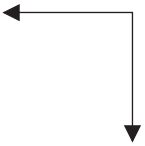
B.



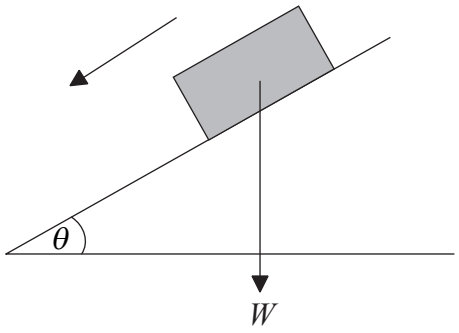
C.



D.



9. A body of weight W is sliding down an inclined plane at constant speed. The plane makes an angle θ to the horizontal.



Which of the following is the magnitude of the frictional force acting on the block?

A. W

B. $W\cos\theta$

C. $W\tan\theta$

D. $W\sin\theta$

10. Which of the following is a correct statement of Newton's second law?

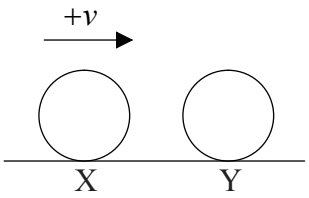
A. The change in momentum of a body is proportional to the external force acting on the body.

B. The force acting on a body is equal to the acceleration of the body.

C. The rate of change of momentum of a body is equal to the external force acting on the body.

D. The force acting on a body is proportional to the mass of the body.

11. A ball X is sliding along a horizontal surface. It collides with an identical ball Y that is at rest.



The velocity of ball X just before the collision is $+v$.

Which of the following is a possible velocity of X and of Y immediately after the collision?

	Velocity of X	Velocity of Y
A.	0	$+v$
B.	$-v$	$+v$
C.	$-\frac{v}{2}$	$+\frac{v}{2}$
D.	$-v$	0

12. The graph shows the variation with time t of the magnitude of the momentum p of a body.

Which of the following is a correct statement about the magnitude of the force acting on the body?

A. It is changing at a constant rate of $2.0\times10^{4}\,\text{N s}^{-1}$.

B. It is changing at a constant rate of $0.36\,\text{N s}^{-1}$.

C. It is constant and equal to $2.0\times10^{4}\,\text{N}$.

D. It is constant and equal to $0.36\,\text{N}$.

13. The work done on an object by a constant force is equal to

A. the power developed by the force × distance moved by the object.

B. magnitude of the force × displacement of the object in the direction of the force.

C. magnitude of the force × distance moved by the object.

D. the power developed by the force × displacement of the object in the direction of the force.

14. A car is moving at constant speed round a bend on a horizontal road. The centripetal acceleration of the car is provided by the

A. traction force of the engine only.

B. traction force of the engine and the friction force between the tyres and the road.

C. friction force between the tyres and the road and the weight of the car.

D. friction force between the tyres and the road only.

15. A lump of ice at 0 °C is placed into water at 0 °C. Assuming that no thermal energy is lost to the surroundings, which of the following statements is true regarding the melting of the ice and the temperature change?

	Melting of ice	Temperature change
A.	some of the ice will melt	the overall temperature of the water will initially fall before going back to 0 °C
B.	some of the ice will melt	the overall temperature of the water will remain the same
C.	none of the ice will melt	the temperature of the ice and water will remain the same
D.	none of the ice will melt	the overall temperature of the water will fall

16. A small copper sphere at 90 °C is placed in a beaker of water which has an initial temperature of 20 °C. The maximum temperature of the water is measured to be 31 °C.

Which of the following is the most correct statement?

A. Some of the vibrational kinetic energy of the copper atoms has been transferred to the water molecules.

B. The energy of the copper atoms has been partially destroyed.

C. Thermal energy from the copper atoms has been used mainly to break bonds between the water molecules.

D. The results of this experiment can be used to find the specific latent heat of vaporization for water.

17. An isolated container is divided into two equal volumes by a partition. In each part of the container there is an ideal gas. They have the same pressure P. The partition is removed. Which of the following is the final pressure?

A. $\frac{P}{2}$

B. P

C. $\frac{3P}{2}$

D. $2P$

18. When a balloon is inflated the walls of the balloon experience a pressure due to the gas inside. According to the kinetic theory of gases this pressure is caused by the

A. molecular forces between gas molecules.

B. transfer of momentum from the gas molecules to the walls.

C. strong nuclear force between the gas molecules and the walls.

D. transfer of mass from the gas molecules to the walls.

19. A transverse wave is moving along a string. Two points on the string are separated by half a wavelength. The velocities of these points are always

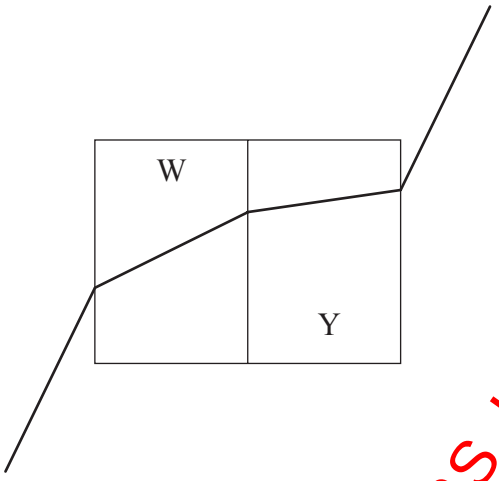
A. constant.

B. in a direction parallel to the direction of propagation of the wave.

C. opposite to each other.

D. the same as each other.

20. A light ray travels from a vacuum into two transparent rectangular blocks. The blocks have refractive indices W and Y.



Which of the following is true?

A. $Y < W < 1$

B. $Y < 1 < W$

C. $W < 1 < Y$

D. $1 < W < Y$

21. Light of wavelength λ in air travels from air into a glass block of refractive index n. Which of the following is the wavelength of the light in the glass?

A. $n\lambda$

B. $\frac{n}{\lambda}$

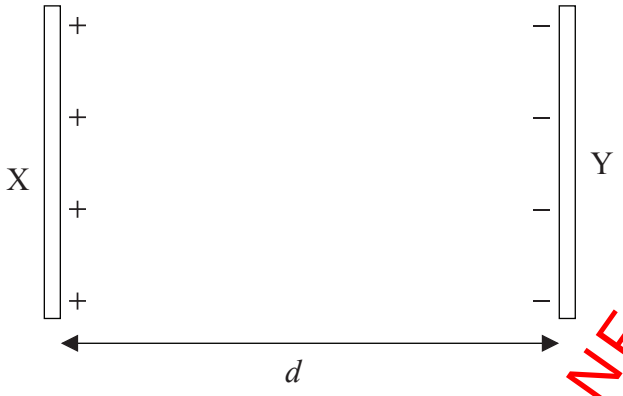
C. $\frac{\lambda}{n}$

D. λ

22. The fundamental mode of a vibrating string has frequency f and wavelength λ. Which of the following gives the correct frequency and wavelength for the fundamental mode of an identical string of half the length and the same tension?

	Frequency	Wavelength
A.	$2f$	$\frac{\lambda}{2}$
B.	$2f$	2λ
C.	$\frac{f}{2}$	2λ
D.	$\frac{f}{2}$	$\frac{\lambda}{2}$

23. The diagram below shows two charged parallel plates X and Y in a vacuum. X is positively charged and Y is negatively charged. The distance between the plates is d.



The magnitude of the charge on each plate is the same. A particle with charge $+q$ is accelerated from rest from plate X to plate Y. The kinetic energy of the particle when it reaches Y is K.

Which of the following is a correct expression for the magnitude of the electric field strength between plates X and Y?

A. $\frac{K}{qd}$

B. $\frac{Kd}{q}$

C. $\frac{qd}{K}$

D. $\frac{q}{Kd}$

24. An electron is accelerated from rest through a potential difference of 2.0×10^3 V. After acceleration, which of the following is the kinetic energy of the electron?

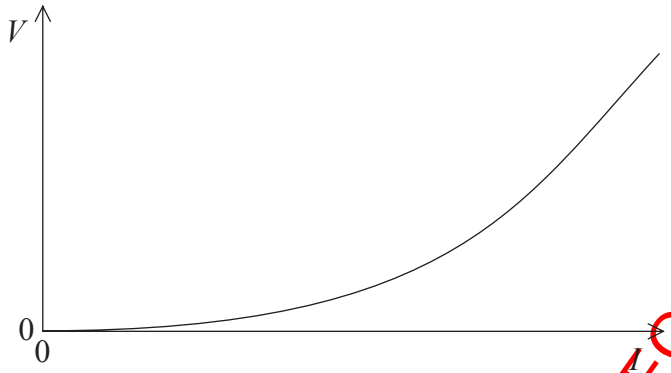
A. 8.0×10^{-23} J

B. 3.2×10^{-16} eV

C. 2.0×10^3 eV

D. 2.0×10^3 J

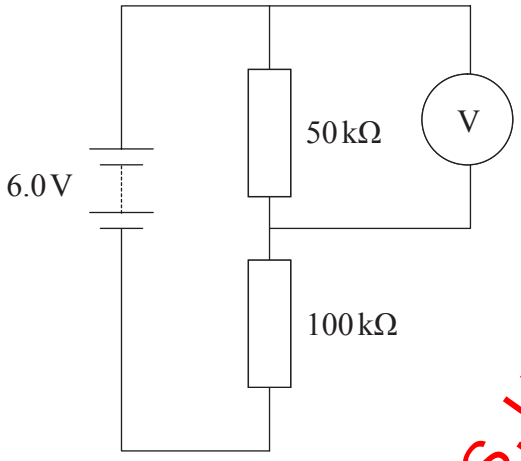
25. The graph shows the variation with the current I in a filament lamp of the potential difference V.



Which of the following is correct regarding the resistance of the filament and its temperature as the current is increasing in the filament?

	Resistance	Temperature
A.	equals $\frac{V}{I}$ at any point	increasing
B.	equals $\frac{V}{I}$ at any point	constant
C.	equals gradient of graph	increasing
D.	equals gradient of graph	constant

26. A resistor of resistance 50 kΩ and a resistor of resistance 100 kΩ are connected in series with a battery of e.m.f. 6.0 V and negligible internal resistance.



An ideal voltmeter is connected across the 50 kΩ resistor. Which of the following is the reading on the voltmeter?

A. 6.0 V

B. 4.0 V

C. 2.0 V

D. 1.2 V

27. Two long, parallel wires are separated by a distance of 1.0 m. The current in each wire is 1.0 A. Which of the following is the magnitude of the force on 1.0 m length of each wire?

A. $2\pi\times10^{7}$ N

B. 2×10^{7} N

C. $2\pi\times10^{-7}$ N

D. 2×10^{-7} N

28. Which of the following gives evidence to support the existence of atomic energy levels?

A. α-particle scattering

B. Absorption spectra

C. The existence of isotopes

D. β-decay

29. An α-particle is produced in a nuclear reaction. The equation for the reaction is shown below.

$$^{6}_{3}\text{Li} + {}^{1}_{0}\text{n} = \alpha + \text{X}$$

Which of the following correctly identifies the atomic number and mass number of the nuclide X?

	Atomic number	Mass number
A.	1	1
B.	3	1
C.	1	3
D.	1	2

30. A freshly prepared sample contains 4.0 μg of the isotope iodine-131. The half-life of iodine-131 is 8 days. Which of the following is the best estimate for the mass of the iodine-131 remaining after 24 days?

A. 1.3 μg

B. 1.0 μg

C. 0.5 μg

D. Zero