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International Baccalaureate
Baccalauréat International
Bachillerato Internacional

PHYSICS
STANDARD LEVEL
PAPER 1

Wednesday 6 November 2013 (morning)

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

1.   The sides of a square are measured to be 5.0 ± 0.2 cm. Which of the following gives the area of the square and its uncertainty?

   A. 25.0 ± 0.2 cm^2

   B. 25.0 ± 0.4 cm^2

   C. 25 ± 2 cm^2

   D. 25 ± 4 cm^2

2.   Which of the following lists two vector quantities and one scalar quantity?

   A.   force, mass, time

   B.   acceleration, energy, momentum

   C.   distance, impulse, power

   D.   density, pressure, temperature

3.   A tennis ball is dropped from the top of a high building. Air resistance **cannot** be neglected. Which graph represents the variation with time t of the magnitude of the acceleration a of the ball before it hits the ground?
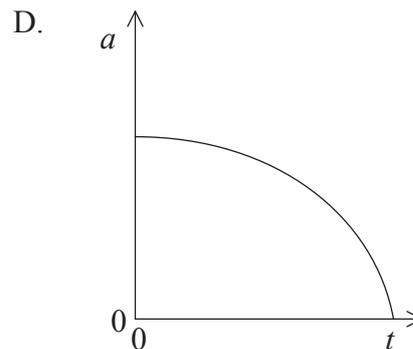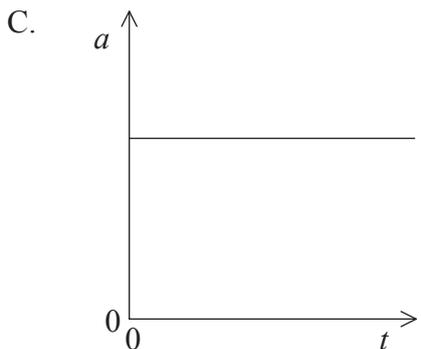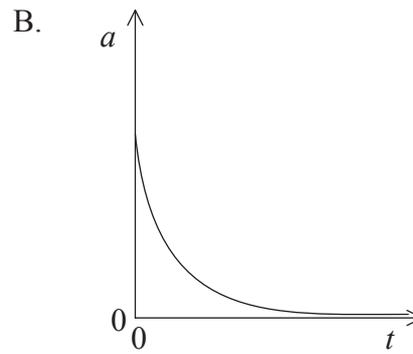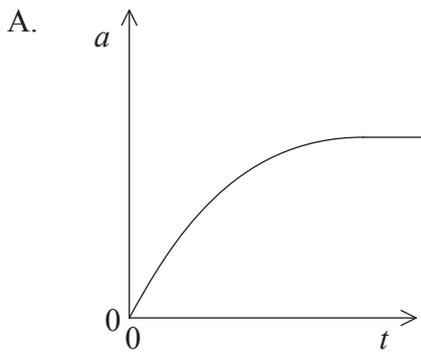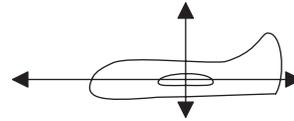
4. A model plane flies with constant velocity at constant height. Which diagram represents the forces acting on the plane?
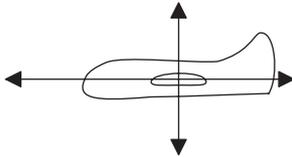
A.
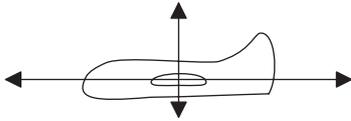
B.

C.

D.
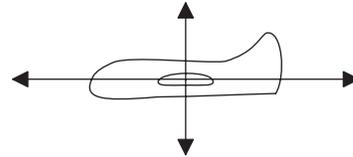
5. The net force on a body is F. The impulse of F is equal to the

    A.   change in momentum of the body.

    B.   rate of change of momentum of the body.

    C.   change of kinetic energy of the body.

    D.   change of total energy of the body.

6. In an inelastic collision

    A.   momentum and kinetic energy are both conserved.

    B.   momentum is conserved but kinetic energy is not.

    C.   kinetic energy is conserved but momentum is not.

    D.   neither momentum nor kinetic energy are conserved.

7. A force which increases uniformly from 0 to a maximum value of F is applied to an object. The object does not move until the force exceeds $0.5F$. As the force increases from $0.5F$ to F the object moves a distance x in the direction of the force. What is the work done by this force?

A. $0.25Fx$

B. $0.5Fx$

C. $0.75Fx$

D. Fx

8. A body moves with uniform speed around a circle of radius r. The period of the motion is T. What is the speed of the body?

A. $\dfrac{2\pi r}{T}$

B. $\dfrac{2\pi T}{r}$

C. Zero

D. $\dfrac{\pi r^2}{T}$

9. Molar mass is defined as

A. the number of particles in one mole of a substance.

B. $\dfrac{1}{12}$ the mass of one atom of carbon-12.

C. the mass of one mole of a substance.

D. the number of particles in $\dfrac{1}{12}$ of a mole of carbon-12.

10. Which of the following is true about boiling and evaporation?

|	**Boiling**	**Evaporation**
A.	occurs throughout liquid	occurs at liquid surface
B.	occurs throughout liquid	occurs throughout liquid
C.	occurs at liquid surface	occurs at liquid surface
D.	occurs at liquid surface	occurs throughout liquid

11. A solid of mass m is initially at temperature ΔT below its melting point. The solid has specific heat capacity c and specific latent heat of fusion L. How much thermal energy must be transferred to the solid in order to melt it completely?

    A. $mL + mc$

    B. $mc + mL\Delta T$

    C. $mc\Delta T + L\Delta T$

    D. $mc\Delta T + mL$

12. For a body undergoing simple harmonic motion the velocity and acceleration are

    A.   always in the same direction.

    B.   always in opposite directions.

    C.   in the same direction for a quarter of the period.

    D.   in the same direction for half the period.

13. Which graph of displacement x against time t represents the motion of a critically damped body?

A.

B.

C.

D.
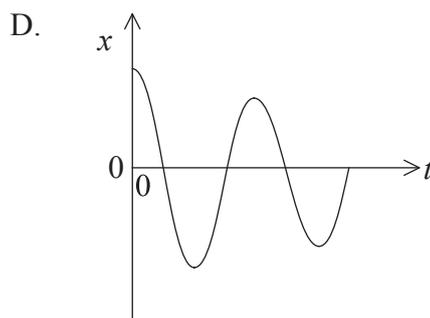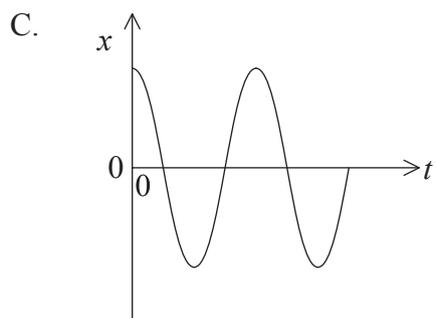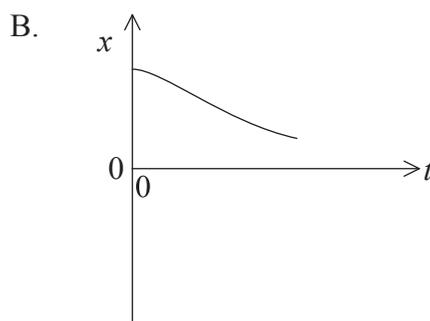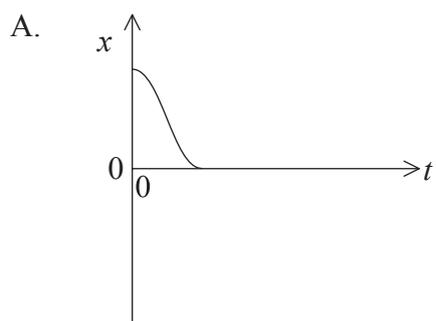
14. Which of the following correctly relates the direction of oscillation of the particles in a medium to the direction of energy propagation for transverse and longitudinal waves?

	Transverse wave	Longitudinal wave
A.	perpendicular	perpendicular
B.	perpendicular	parallel
C.	parallel	perpendicular
D.	parallel	parallel

15. Which of the following relates the amplitude A of a travelling wave to the intensity I?

A. $A \propto I^{-1}$

B. $A \propto I^{-\frac{1}{2}}$

C. $A \propto I^{\frac{1}{2}}$

D. $A \propto I^{2}$

16. Two identical waves of wavelength λ leave two sources in phase. The waves meet and superpose after travelling different distances. Which path difference will result in destructive interference?

A. $\dfrac{\lambda}{4}$

B. $\dfrac{\lambda}{2}$

C. $\dfrac{3\lambda}{4}$

D. λ

17. A resistor X of resistance R is made of wire of length L and cross-sectional area A. Resistor Y is made of the same material but has a length $4L$ and a cross-sectional area $2A$. X and Y are connected in series. What is the total resistance of the combination?

A. $1.5R$

B. $2R$

C. $3R$

D. $9R$

18. A light dependent resistor L is connected in series with a cell C and a fixed resistor R. The cell has a negligible internal resistance. V_{OUT} is the output voltage across L.
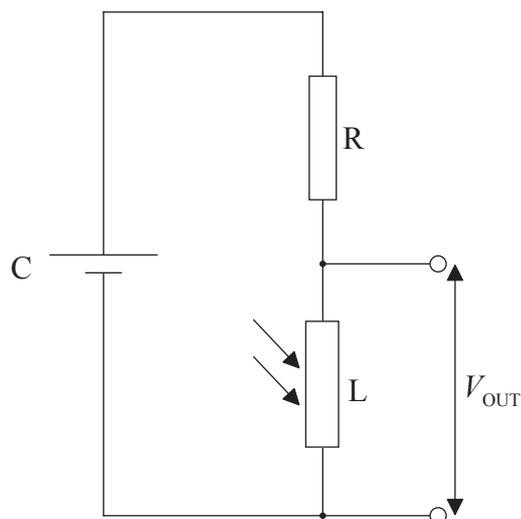

Which change will increase V_{OUT}?

A.   Connect another resistor in parallel with L

B.   Decrease the intensity of light on L

C.   Increase the resistance of R

D.   Decrease the emf of C

19. Each of the resistors in the circuit has a resistance of $2.0\,\Omega$. The cell has an emf of $3.0\,V$ and negligible internal resistance. The ammeter has negligible resistance.

3.0 V
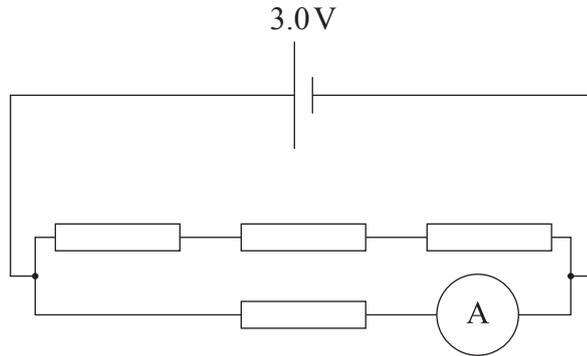
What is the ammeter reading?

A. 0.4 A

B. 0.5 A

C. 1.5 A

D. 2.0 A

20. Which diagram represents the pattern of electric field lines of two small positive point charges held at the positions shown?

A.

B.

C.

D.

Turn over
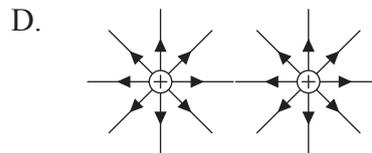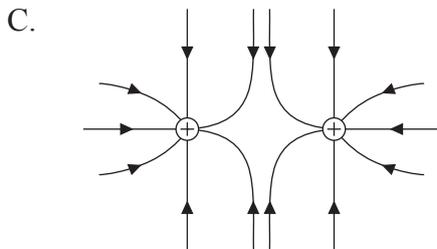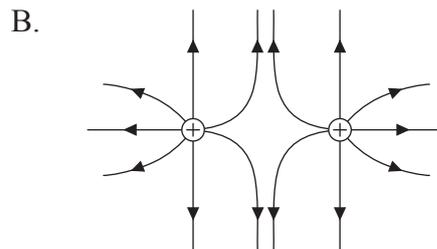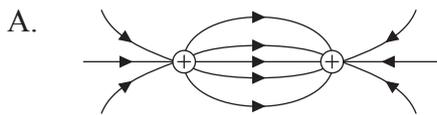
21. The force F between particles in gravitational and electric fields is related to the separation r of the particles by an equation of the form

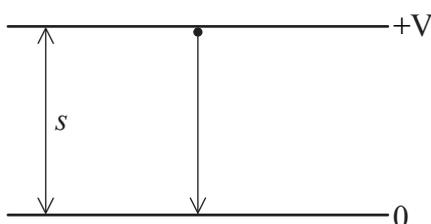$$F = a\frac{bc}{r^2}.$$

Which of the following identifies the units for the quantities a, b and c for a gravitational field?

	a	b and c
A.	$\mathrm{N\,m^2\,C^{-2}}$	C
B.	$\mathrm{N\,m^2\,C^{-2}}$	kg
C.	$\mathrm{N\,m^2\,kg^{-2}}$	C
D.	$\mathrm{N\,m^2\,kg^{-2}}$	kg

22. An electron of mass m_e and charge e accelerates between two plates separated by a distance s in a vacuum. The potential difference between the plates is V.

What is the acceleration of the electron?

A. $\dfrac{m_e eV}{s}$

B. $\dfrac{m_e V}{es}$

C. $\dfrac{eV}{m_e s}$

D. $\dfrac{V}{m_e es}$

23. In a particular atom, the nucleon number is the total number of

    A.   protons.

    B.   neutrons.

    C.   electrons.

    D.   protons and neutrons.

24. For which quantity can the unit $\text{MeV}\,c^{-2}$ be used?

    A.   Mass

    B.   Momentum

    C.   Kinetic energy

    D.   Binding energy

25. Uranium-238 $\left(^{238}_{92}\text{U}\right)$ forms a nucleus of plutonium-239 $\left(^{239}_{94}\text{Pu}\right)$ as a result of

    A.   electron capture followed by alpha decay.

    B.   electron capture followed by beta decay.

    C.   neutron capture followed by alpha decay.

    D.   neutron capture followed by two beta decays.

26. In the production of electric power, an advantage of using photovoltaic cells rather than fossil fuels is that the photovoltaic cells

    A.   can be effective in any location.

    B.   can be used continuously.

    C.   have low initial set-up costs.

    D.   are more environmentally friendly when in use.

27. What is the main role of the control rods and the main role of the moderator in a thermal fission reactor?

	Control Rods	**Moderator**
A.	decrease neutron speed	decrease neutron speed
B.	decrease neutron speed	absorb neutrons
C.	absorb neutrons	decrease neutron speed
D.	absorb neutrons	absorb neutrons

28. An oscillating water column (OWC) ocean-wave energy converter uses waves to alter the air pressure in a chamber. Which energy resources must have been involved for this method to generate electricity?

    I.   Tides

    II.   Wind

    III. Solar

A.   I only

B.   II only

C.   I and II only

D.   II and III only

29. The surface temperature of a black-body emitter is doubled. By what factor does the power emitted by the body increase?

A.   32

B.   16

C.   4

D.   2

30. Which option is **not** a possible solution to reduce the enhanced greenhouse effect?

A.   Decommission nuclear power plants

B.   Replace the use of coal and oil with natural gas

C.   Use combined heating and power systems (CHP)

D.   Use hybrid motor vehicles