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PHYSICS
STANDARD LEVEL
PAPER 1

Tuesday 20 May 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.   Which list gives the masses of the particles in ascending order of magnitude?

least → greatest

A.	α-particle	β-particle	proton
B.	proton	α-particle	β-particle
C.	proton	β-particle	α-particle
D.	β-particle	proton	α-particle

2.   The kilowatt-hour (kW h) is equivalent to

A. 6.0×10^4 J .

B. 6.0×10^4 W .

C. 3.6×10^6 J .

D. 3.6×10^6 W .

3.   A small steel ball falls from rest through a distance of 3 m. When calculating the time of fall, air resistance can be ignored because

A.   air is less dense than steel.

B.   air resistance increases with the speed of the ball.

C.   the air is not moving.

D.   air resistance is much less than the weight of the ball.

4.   Which of the following contains three scalar quantities?

A.	mass	charge	speed
B.	density	weight	mass
C.	speed	weight	charge
D.	charge	weight	density

5.   The graph shows the variation with time t of the velocity v of an object moving along a straight line.
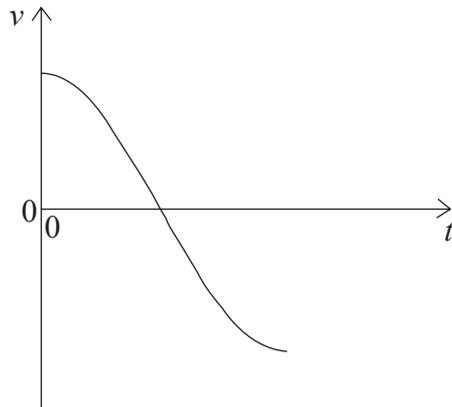
Which graph shows the variation with time t of the acceleration a of the object?

A.

B.

C.

D.

Turn over
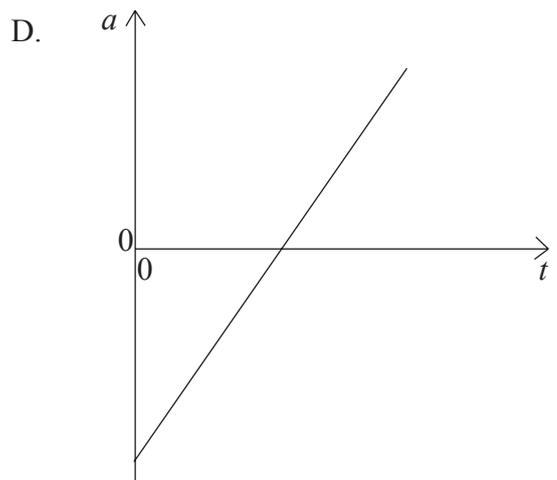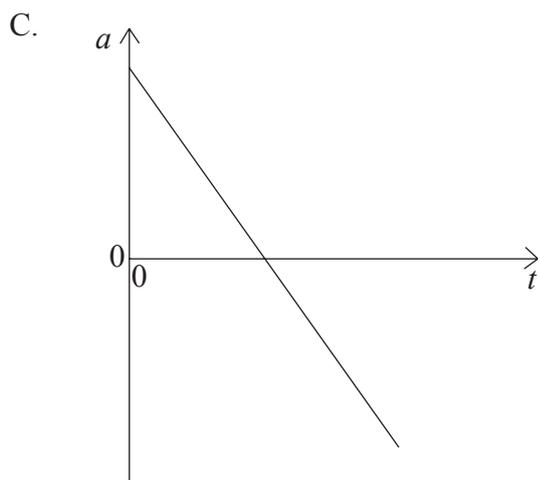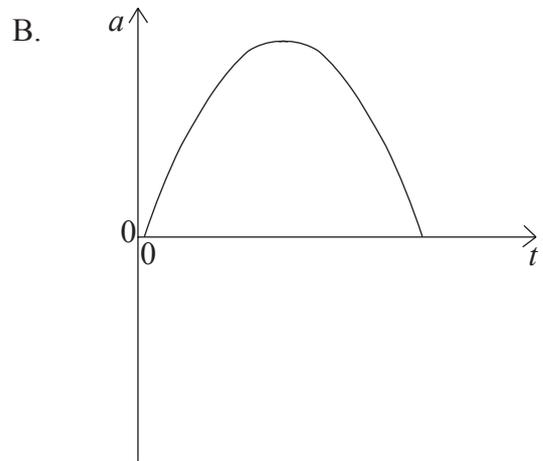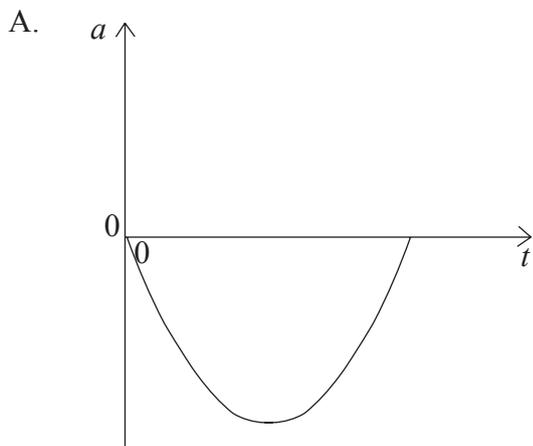
6. Two identical metal spheres are held above the ground as shown.

spheres

(not to scale)
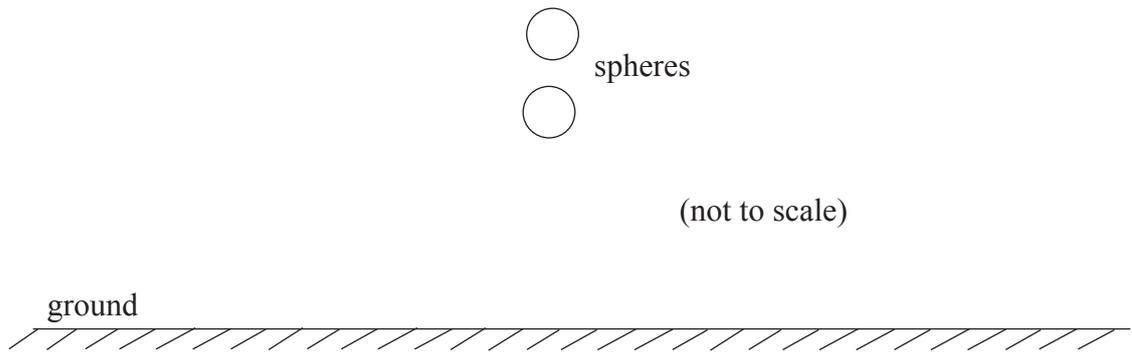
ground

The separation between them is small compared to their distance above the ground. When the spheres are released, the separation of the spheres will

A.   remain constant.

B.   decrease continuously.

C.   increase continuously.

D.   increase initially and then remain constant.

7. An object is falling, in air, towards the Earth's surface.

What changes occur in the acceleration and in the velocity of the object as it approaches terminal velocity?

	acceleration	velocity
A.	decreases to zero	increases continuously
B.	decreases to zero	increases to a constant value
C.	constant	increases to a constant value
D.	constant	increases continously

8. Two unequal masses M and m are joined by a light inextensible string. The string passes over a light frictionless pulley as shown.
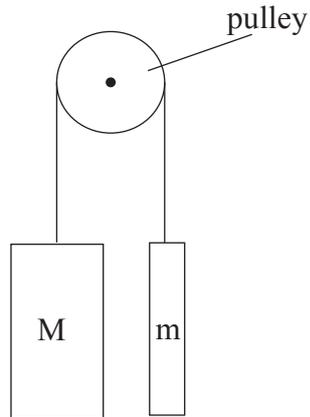
The masses accelerate when released.

Which diagram is the correct free-body diagram for the two masses?
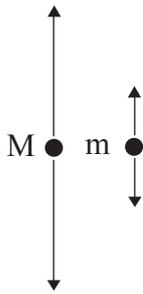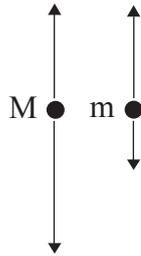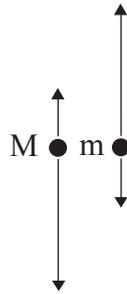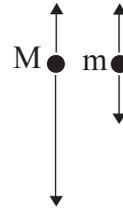
9. What is the condition for an object to be in translational equilibrium?

A. The forces acting upwards are equal to the forces acting downwards.

B. The object must be at rest.

C. The object must be moving at constant speed.

D. There is no resultant force on the object in any direction.

10. A ball of mass M hits a wall at speed V normal to the wall. It rebounds with speed v normal to the wall as shown below.
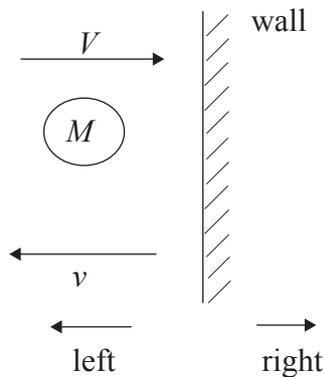
What is the magnitude of the change in momentum of the ball and the direction of the force that the wall exerts on the ball?

	change in momentum	direction of force
A.	$M(V - v)$	to the right
B.	$M(V - v)$	to the left
C.	$M(V + v)$	to the right
D.	$M(V + v)$	to the left

11. A rocket is fired vertically into the air. When the rocket reaches its maximum height, the rocket explodes.

What change, if any, occurs in the momentum and in the kinetic energy of the rocket during the explosion?

	momentum	kinetic energy
A.	increases	increases
B.	increases	constant
C.	constant	increases
D.	constant	constant

12. A box of weight W is moved at constant velocity v along a horizontal floor. There is a constant frictional force F between the box and the floor.

What is the power required to move the box through a distance s?

A. Fs

B. Fv

C. Ws

D. Wv

13. A stone of mass m is attached to a string. The stone is made to rotate in a vertical circle of radius r, as shown.
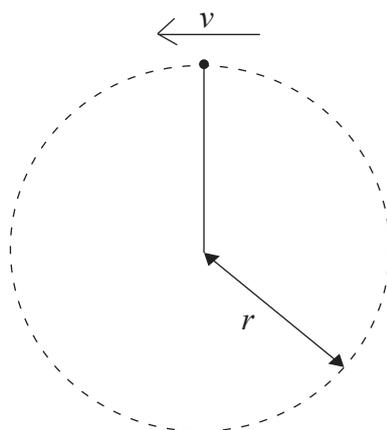
At the point where the stone is vertically above the centre of the circle, the stone has speed v.

Which of the following expressions gives the tension in the string?

A. $mg - \dfrac{mv^2}{r}$

B. $\dfrac{mv^2}{r}$

C. $\dfrac{mv^2}{r} - mg$

D. $\dfrac{mv^2}{r} + mg$

14. A solid is at an initial temperature of 500 K. The solid is heated so that its temperature rises by 50 K.

What are the initial temperature and the temperature rise of the solid, as measured on the Celsius scale of temperature?

	initial temperature	temperature rise
A.	227 °C	50 °C
B.	227 °C	323 °C
C.	773 °C	50 °C
D.	773 °C	323 °C

15. A copper block and a steel block each have the same mass. The copper block is at a higher temperature than the steel block.

The blocks are placed in thermal contact and they then reach thermal equilibrium. There is no energy exchange with the surroundings.

How do the magnitude of the change in temperature ΔT and the magnitude of the change in internal energy ΔU of the two blocks compare?

	ΔT	ΔU
A.	same	same
B.	same	different
C.	different	same
D.	different	different

16. The specific latent heat of fusion of a substance is the quantity of thermal energy required to convert, at constant temperature,

A.   a solid to a liquid.

B.   unit mass of solid to liquid.

C.   a liquid to a solid.

D.   unit mass of liquid to solid.

17. A sample of an ideal gas is contained in a cylinder. The volume of the gas is suddenly decreased. A student makes the following statements to explain the change in pressure of the gas.

    I.   The average kinetic energy of the gas atoms increases.

    II.   The atoms of the gas hit the walls of the cylinder more frequently.

    III.   There are more atoms that are able to collide with the walls of the cylinder.

Which of these statements is true?

A.   I and II only

B.   I and III only

C.   II and III only

D.   I, II and III

18. A transverse travelling wave has amplitude A_0 and wavelength λ.

The distance between a crest and its neighbouring trough, measured in the direction of energy transfer of the wave is equal to

A. A_0.

B. $2A_0$.

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

D. λ.

19. A light wave travelling through a vacuum is incident on a block of glass. What change, if any, occurs in the frequency and amplitude of the wave as it travels into the glass?

	frequency	amplitude
A.	decreases	decreases
B.	decreases	constant
C.	constant	decreases
D.	constant	constant

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20. What is a correct description of the Doppler effect in sound?

    A.   Change in frequency of the source due to motion of the source.

    B.   Apparent change in frequency of the source due to relative motion of source and observer.

    C.   Change in wavelength of the source due to motion of the observer.

    D.   Apparent change in wavelength of the source due to motion of the observer.

21. A long tube is filled with water. A tuning fork of frequency f is sounded above the top of the tube, as shown.
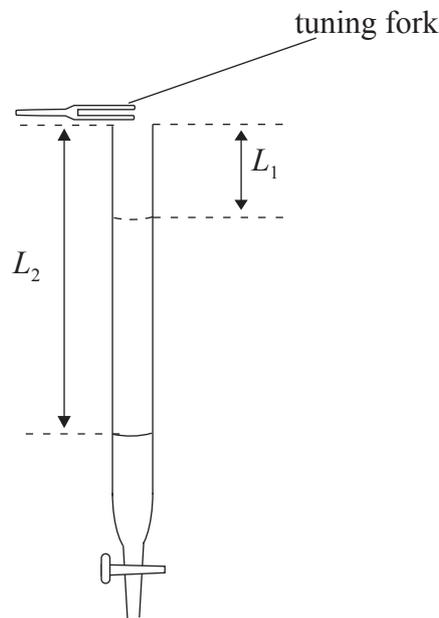
Water is gradually run out of the tube. A loud sound is heard first when the length of the air column in the tube is L_1. The next loud sound is heard when the length of the air column is L_2.

Which of the following is a correct expression for the speed of sound in the tube?

    A. $2f \times L_1$

    B. $f \times L_2$

    C. $f \times (L_2 - L_1)$

    D. $2f \times (L_2 - L_1)$

22. A metal conductor is negatively charged. It is connected to earth using a metal wire, as illustrated below.
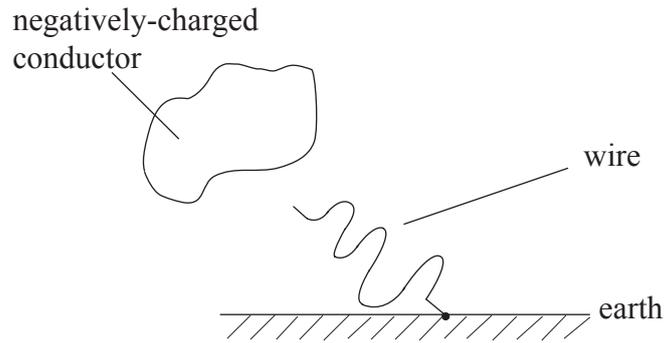
What is the movement of charge as the conductor is earthed?

A. Positive charge moves from earth to the conductor.

B. Negative charge moves to earth from the conductor.

C. Negative charge moves from the conductor and positive charge moves from earth.

D. Positive charge from the wire moves to the conductor and negative charge moves to earth.

23. Two charged plastic balls are separated by a distance d in a vertical insulating tube, as shown.
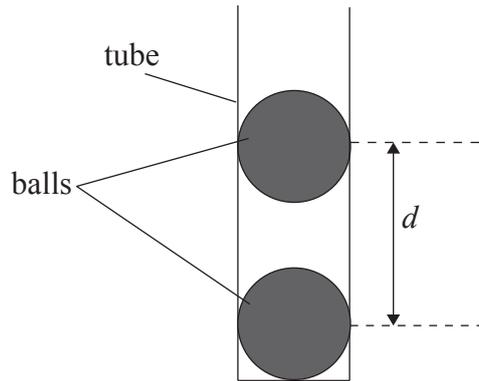
The charge on each ball is doubled.

Coulomb's law applies to the force between the balls and friction with the walls of the tube is negligible.

What is now the separation of the balls?

A. $\dfrac{d}{2}$

B. d

C. $2d$

D. $4d$

24. The graph shows the current-voltage (*I-V*) characteristic of an electrical component.
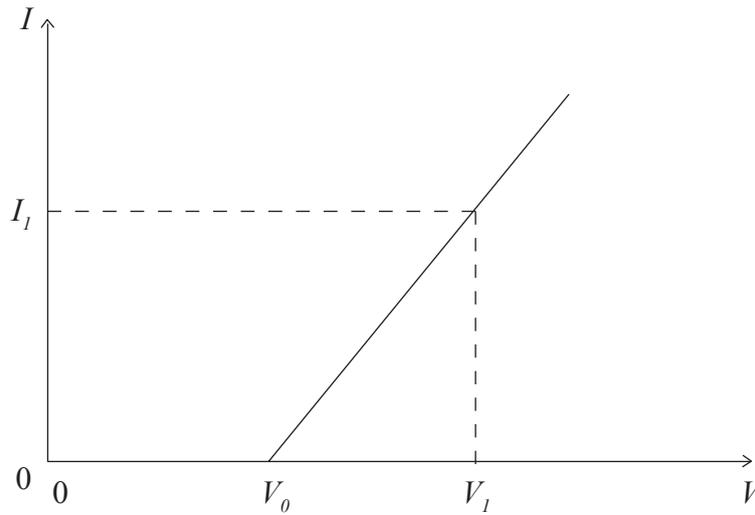
What is the resistance of the component at a potential difference V_1 and how does the resistance change, if at all, between potential differences V_0 and V_1.

	resistance at V_1	change between V_0 and V_1
A.	$\dfrac{(V_1 - V_0)}{I_1}$	no change
B.	$\dfrac{(V_1 - V_0)}{I_1}$	decreases
C.	$\dfrac{V_1}{I_1}$	no change
D.	$\dfrac{V_1}{I_1}$	decreases

25. Three resistors P, Q and R, are each labelled 100 Ω. They are connected as shown.
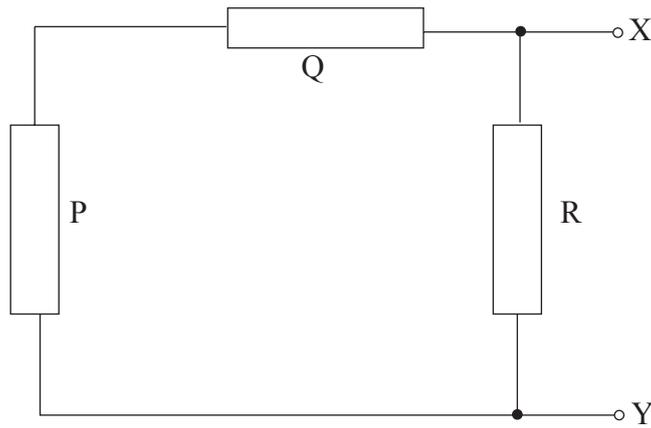
The total resistance, when measured between points X and Y, is found to be 200 Ω.

What is the correct explanation for the resistance reading?

A.   Resistor R is zero

B.   Resistor R is infinite

C.   Resistor P is zero

D.   Resistor P is infinite

26. A straight conductor is in the plane of a uniform magnetic field as shown.

current I

magnetic field

θ
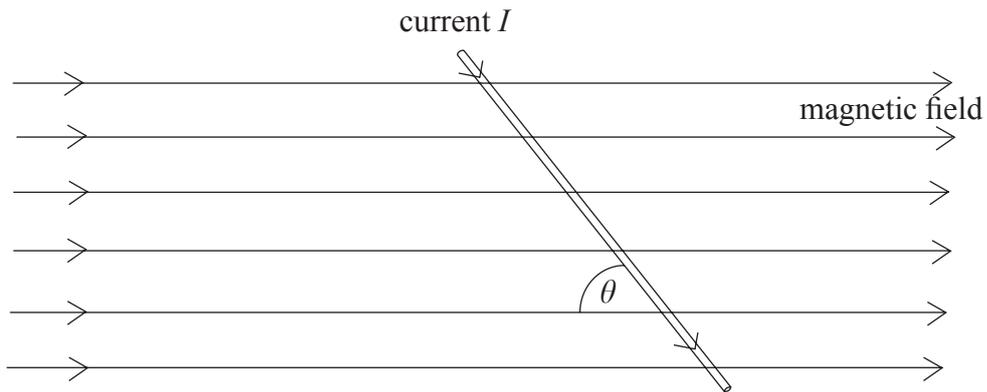
The current in the conductor is I and the conductor is at an angle θ to the magnetic field. The force per unit length on the conductor due to the current in the magnetic field is P. Which is the correct expression for the magnitude of the magnetic field strength?

A. $\dfrac{P\sin\theta}{I}$

B. $\dfrac{P\cos\theta}{I}$

C. $\dfrac{P}{I\sin\theta}$

D. $\dfrac{P}{I\cos\theta}$

27. The function of the split-ring commutator in a simple direct-current (d.c.) motor is to reverse the direction of the current

A. in the coil, so as to control the speed of the coil.

B. in the coil, so that the coil will rotate continuously.

C. in the external circuit, so as to control the speed of the coil.

D. in the external circuit, so as to change the direction of the magnetic field.

28. A student suggests that the following transformation may take place.
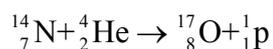
$$^{14}_{7}N + ^{4}_{2}He \rightarrow ^{17}_{8}O + ^{1}_{1}p$$

Measurement of rest masses shows that

total rest mass $\left(^{14}_{7}N + ^{4}_{2}He\right) <$ total rest mass $\left(^{17}_{8}O + ^{1}_{1}p\right)$.

The student concludes that the reaction will

A.   take place if the helium nucleus has sufficient kinetic energy.

B.   always take place and the proton will be emitted with kinetic energy.

C.   always take place but the proton will have zero kinetic energy.

D.   never take place because there is no mass defect.

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

A.   Alpha-particle scattering

B.   Continuous emission spectra

C.   Discrete energies of gamma radiation

D.   Line absorption spectra

30. Nuclide X has a half-life of 1 day and nuclide Y has a half-life of 5 days. In a particular sample, the activities of X and Y are found to be equal.

When the activity is tested again after 10 days, the activity will be

A.   entirely due to nuclide X.

B.   due equally to nuclides X and Y.

C.   mostly due to nuclide X.

D.   mostly due to nuclide Y.