INTERNATIONAL BACCALAUREATE
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PHYSICS
STANDARD LEVEL
PAPER 1

Monday 8 May 2000 (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 one of the following is a scalar quantity?

    A.   Electric field

    B.   Acceleration

    C.   Power

    D.   Momentum

2. A motor car travels on a circular track of radius a, as shown in the figure. When the car has travelled from P to Q its displacement from P is
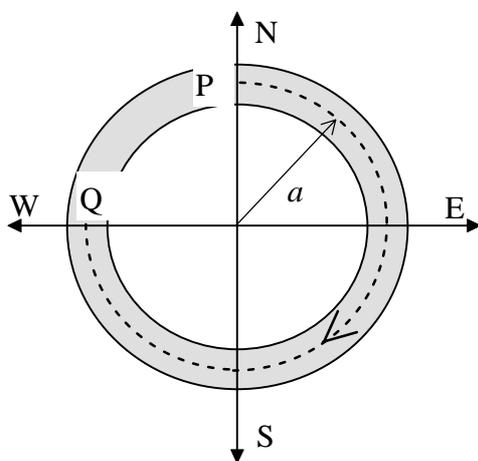
    A. $a\sqrt{2}$ southwest.

    B. $a\sqrt{2}$ northeast.

    C. $\dfrac{3\pi a}{2}$ southwest.

   D. $\dfrac{3\pi a}{2}$ northeast.

220-235

3.   The figure below shows the forces on a fish as it swims with a constant velocity.
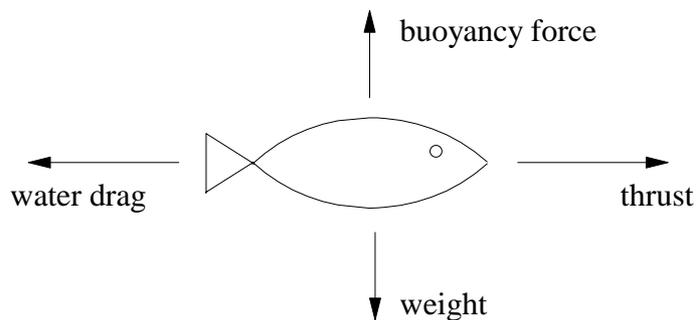

The resultant (net) force acting on the fish is

A.   zero.

B.   upwards.

C.   downwards.

D.   forwards.

4.   A stone falls towards the Earth. The force that the stone exerts on the Earth is

A.   zero.

B.   less than the force the Earth exerts on the stone.

C.   greater than the force the Earth exerts on the stone.

D.   equal to the force the Earth exerts on the stone.

5. A steady horizontal stream of air blows a lamp suspended by a light wire so that the wire is at an angle θ to the vertical as shown. If the tension in the wire is T, the horizontal force on the lamp, F, is given by
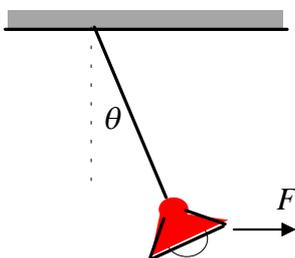
A. $\dfrac{T}{\cos\theta}$.

B. $T\sin\theta$.

C. $T\cos\theta$.

D. $\dfrac{T}{\sin\theta}$.

6. A small object, suspended by a string, rotates with constant speed, in a horizontal circle as shown in the figure. Point O is at the centre of the circle.
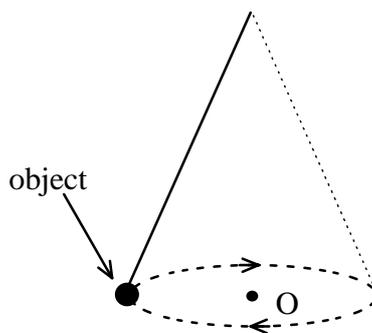
Which one of the following statements is correct?

A.   The object is in equilibrium

B.   There is a resultant force on the object directed away from O

C.   A force acts on the object in the direction of its motion

D.   There is a resultant force on the object directed towards O

7. Two vehicles, A and B, are moving directly towards each other. Vehicle A has a mass of 1000 kg and speed 5.0 ms^{-1}. Vehicle B has a mass of 500 kg and speed of 20.0 ms^{-1}. The magnitude of the total momentum of the two vehicles is

    A.   zero.

    B.   5000 $kg\,ms^{-1}$.

    C.   10 000 $kg\,ms^{-1}$.

    D.   15 000 $kg\,ms^{-1}$.

8. Marcella gives her baby sister a ride in a cart. She pushes the cart steadily along the length of a horizontal driveway. Starting from rest, at the end of 4 m the cart ends up with a speed of 2 ms^{-1}. Later Marcella's younger brother pushes the cart but with only half as much force. Over what distance would he need to push his baby sister, to give her a speed of 2 ms^{-1}? (Assume the cart wheels spin frictionlessly.)
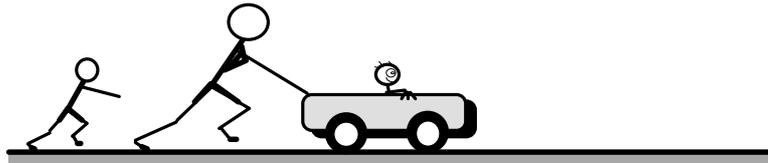
    A.   4 m

   B.   8 m

    C.   16 m

    D.   Further than 16 m

9. A particle is undergoing simple harmonic motion. When it is at its maximum displacement from its equilibrium position, which one of the following about its velocity and acceleration is correct?

	Velocity	**Acceleration**
A.	zero	maximum
B.	zero	zero
C.	maximum	zero
D.	maximum	maximum

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

    A.   average velocity.

    B.   maximum velocity.

    C.   average kinetic energy.

    D.   total kinetic energy.

11. A vacuum flask (or Dewar flask) is an insulated container useful for storing hot or cold liquids (coffee, tea, liquid nitrogen, *etc.*). In its construction a vacuum is used to minimise energy transfer with the environment.


vacuum
between walls
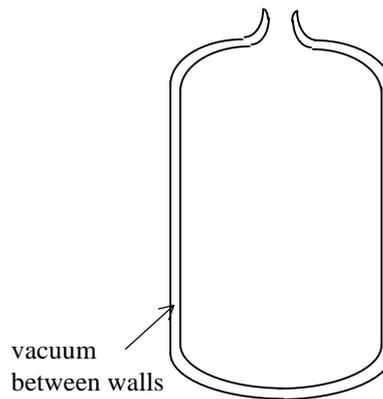
The vacuum reduces

    A.   radiation, convection and conduction losses.

    B.   convection and conduction losses.

   C.   convection losses only.

    D.   radiation losses only.

12. Two identical containers P and Q hold two different ideal gases at the same temperature. The number of moles of each gas is the same. The molecular weight of the gas in container P is twice that of the gas in Q. The ratio of the pressure in P to that of Q will be

A. $\dfrac{1}{2}$.

B. 1.

C. $\sqrt{2}$.

D. 2.

13. Radio waves of wavelength 30 cm have a frequency of about

A. 10 MHz.

B. 90 MHz.

C. 1000 MHz.

D. 9000 MHz.

14. For an organ pipe of length *L*, the fundamental frequency is proportional to

A. *L*.

B. $\dfrac{1}{L}$.

C. $\dfrac{1}{\sqrt{L}}$.

D. $\sqrt{L}$.

15. For a certain standing wave set up in a stretched string the distance from the 2nd node to the 5th node is 60 mm. The wavelength of the standing wave is

A. 20 mm.

B. 30 mm.

C. 40 mm.

D. 50 mm.

16. The diagram below shows a plane **P** wave (pressure wave) from an earthquake, approaching the boundary between two different rock types. The speed of propagation in **rock type 2** is greater than in **rock type 1**.
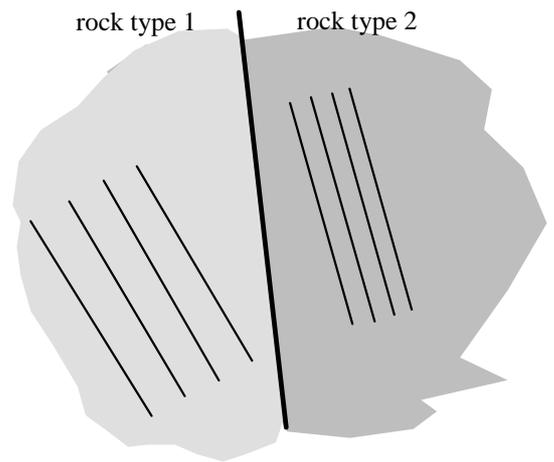

rock type 1   rock type 2
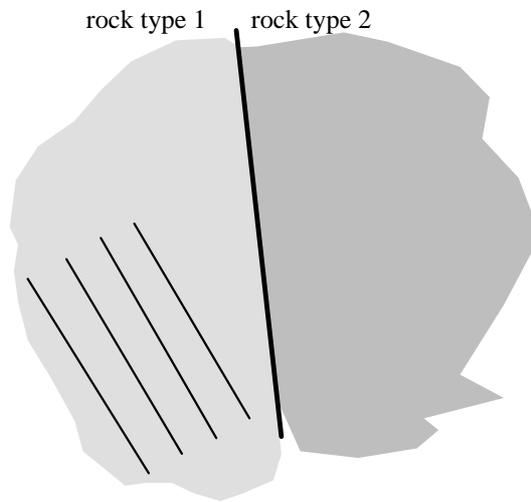
Which one of the following figures correctly shows the wavefronts for the refracted wave?

A.

rock type 1   rock type 2

B.

rock type 1   rock type 2

C.

rock type 1   rock type 2

D.

rock type 1   rock type 2
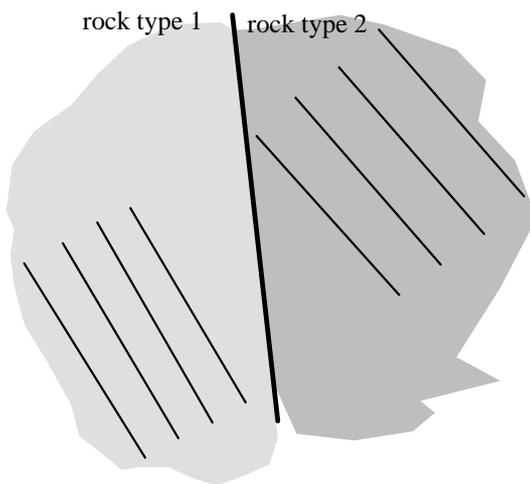
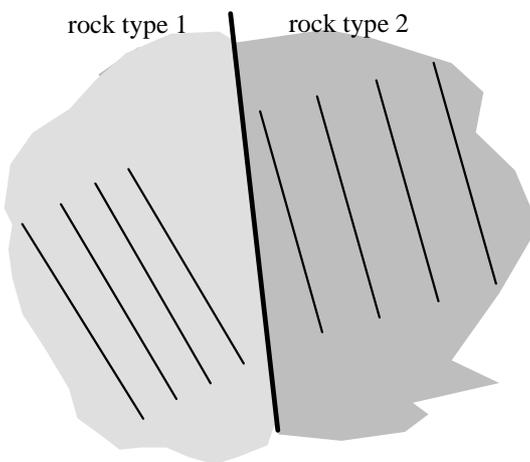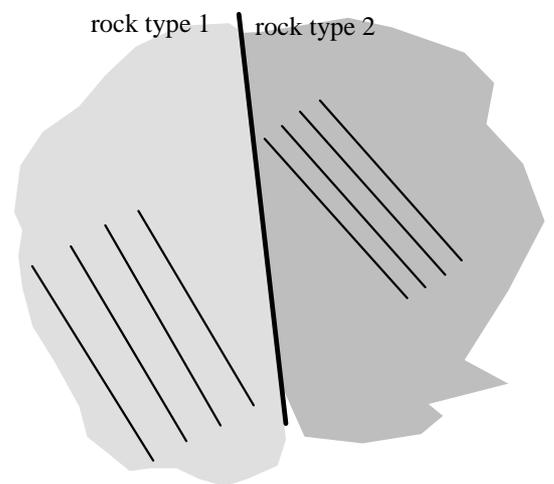**17.** Interference phenomena can be demonstrated using light. This is evidence that

    A.   under some conditions light behaves as a stream of particles.

    B.   light is a transverse wave.

    C.   light is electromagnetic in character.

    D.   light has wave characteristics.

18. Listed below are frequencies of tuning forks that are to be sounded in pairs. The largest number of beats will be heard from which pair of tuning forks?

    A.   201 and 200 Hz

    B.   253 and 260 Hz

    C.   535 and 540 Hz

    D.   1420 and 1424 Hz

19. Two point charges, +2 nC and −1 nC, are fixed in position along a line as shown in the diagram below. A third charge of +1 nC is placed along the line so that the net electrostatic force on it is zero. In which of the three regions **I**, **II**, **III**, could the third charge be placed?
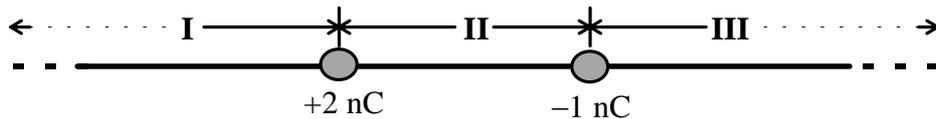

    A.   Region **I** only

    B.   Region **II** only

    C.   Region **III** only

    D.   Regions **I** or **III**

20 Consider the following three statements. In electrostatic situations electric field lines

      I.   can never cross.

      II.   start on positive charges and terminate on negative charges.

      III.   are always perpendicular to the surface of conductors.

Which one of the following combinations is correct?

A.   I, II and III

B.   I only

C.   II only

D.   I and II only

21. Plate 1 and Plate 2 are a pair of charged, parallel metal plates with a potential difference between them. The work done in taking a given charge from one plate to the other is W.

    Plate 1

_____

_____
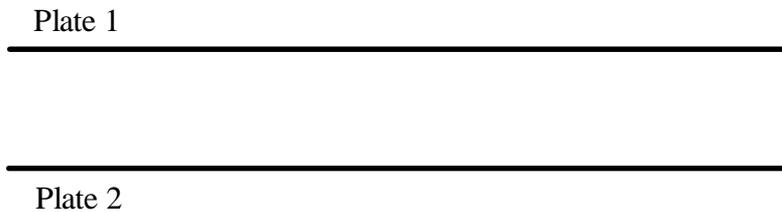
    Plate 2

If the separation of the plates is doubled and the potential difference is kept the same, the work required to take the same amount of charge from one plate to the other is

A. W.

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

C. $2W$.

D. $4W$.

22. An electric heater has three settings for its selector switch – low, medium, and high. The heater has two identical resistive elements that can be connected in three different ways, as shown in the figure.
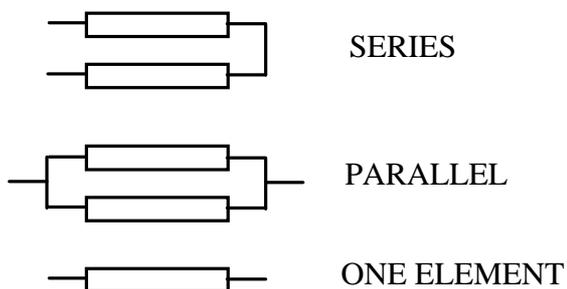
Which line in the table below indicates the way the heating elements must be connected to a power supply in order to provide the three settings?

|	**High**	**Medium**	**Low**
A.	parallel	series	one element
B.	series	parallel	one element
C.	series	one element	parallel
D.	parallel	one element	series

23. In the circuit shown below, 1, 2 and 3 are identical bulbs and switch **S** is closed.
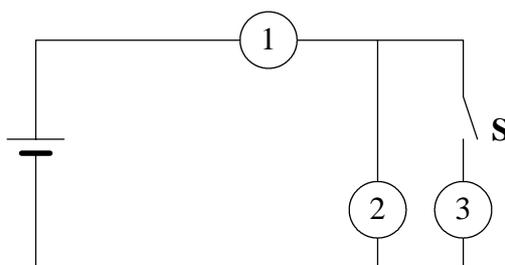
If switch **S** is opened what happens to the brightness of bulbs 1 and 2?

	Bulb 1	**Bulb 2**
A.	the same	brighter
B.	brighter	the same
C.	dimmer	brighter
D.	the same	dimmer

24. Four long straight parallel wires carry equal currents directed vertically out of the page. They are arranged on the corners of a square as shown in the figure below.
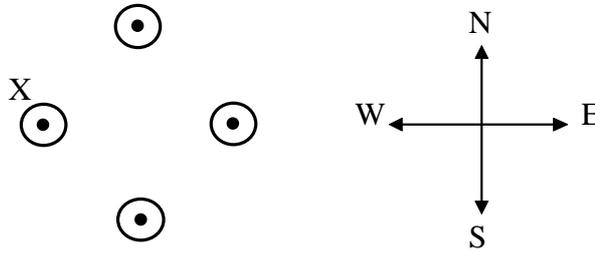
The direction of the resultant magnetic force exerted on the wire labelled X is

A.   south.

B.   north.

C.   west.

D.   east.

25. A long straight wire is in the plane of a rectangular conducting loop of wire. The straight wire carries a constant current I as shown in the figure below and is moved towards the rectangular loop.
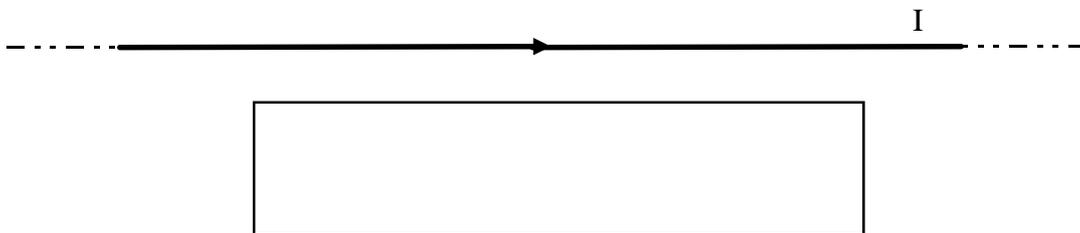
While the wire is being moved towards the rectangular loop, the current in the loop

A.   is always zero.

B.   flows clockwise around the loop.

C.   flows counterclockwise around the loop.

D.   alternates, first one way then the opposite way around the loop.

26. Thomson conducted an experiment to measure the ratio of the charge to mass of cathode rays. At one point in the experiment, an electric field was aligned

    A.   parallel to the gravitational field.

    B.   perpendicular to the gravitational field.

    C.   parallel to a magnetic field.

    D.   perpendicular to a magnetic field.

27. The electron-volt is a unit of

    A.   charge.

    B.   energy.

    C.   electrical potential difference.

    D.   electric field.

28. In early experiments to investigate the nature of the atom, a very thin gold foil was bombarded with alpha-particles. Consider the following three statements.

    I.   There was no measurable deflection for most of the apha-particles

    II.   A large proportion of alpha-particles were deflected through angles greater than $90°$

    III.   It was deduced from this experiment that atoms have a very small, positively charged nucleus

Which of these statements concerning this experiment is FALSE?

    A.   I only

    B.   II only

    C.   I and II

    D.   II and III

Turn over

29. A sample of the isotope $^{238}_{92}U$ has an activity of 12×10^3 Bq and a half-life of 4.5×10^9 years. What can be done to the physical state of the sample of $^{238}_{92}U$ to reduce its activity?

    A.   Lower its temperature.

    B.   Place it in a strong magnetic field.

    C.   Chemically combine it with another element.

    D.   Nothing can be done to reduce its activity.

30. Radioactive Polonium 214 can decay into Polonium 210 by emitting an alpha particle followed by

    A.   a negative beta particle and a gamma ray.

    B.   two negative beta particles.

    C.   an alpha particle.

    D.   an alpha particle and a negative beta particle.