INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

N99/430/S(1)

PHYSICS

Standard Level

Friday 5 November 1999 (afternoon)

Paper 1 — 45 minutes

This examination paper consists of 30 questions.

Each question offers 4 suggested answers.

The maximum mark for this paper is 30.

INSTRUCTIONS TO CANDIDATES

Do NOT open this examination paper until instructed to do so.

Answer ALL questions.

For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

Calculators are NOT permitted for this examination paper.

EXAMINATION MATERIALS

Required:
Optically Read Mark (OMR) answer sheet
Physics SL Data Booklet

Allowed:
A simple translating dictionary for candidates not working in their own language

1. *Equivalent units.* Gravitational field strength may be specified in $N\,kg^{-1}$. Units of $N\,kg^{-1}$ are equivalent to

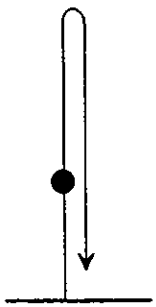
   A. ms^{-1}

   B. ms^{-2}

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

   D. $kg\,ms^{-2}$

2. *Velocity and acceleration of a ball in the air.* A ball is thrown vertically upwards and then comes back down.



During the ball's flight, its **velocity** and **acceleration** vectors are

A. always in opposite directions.

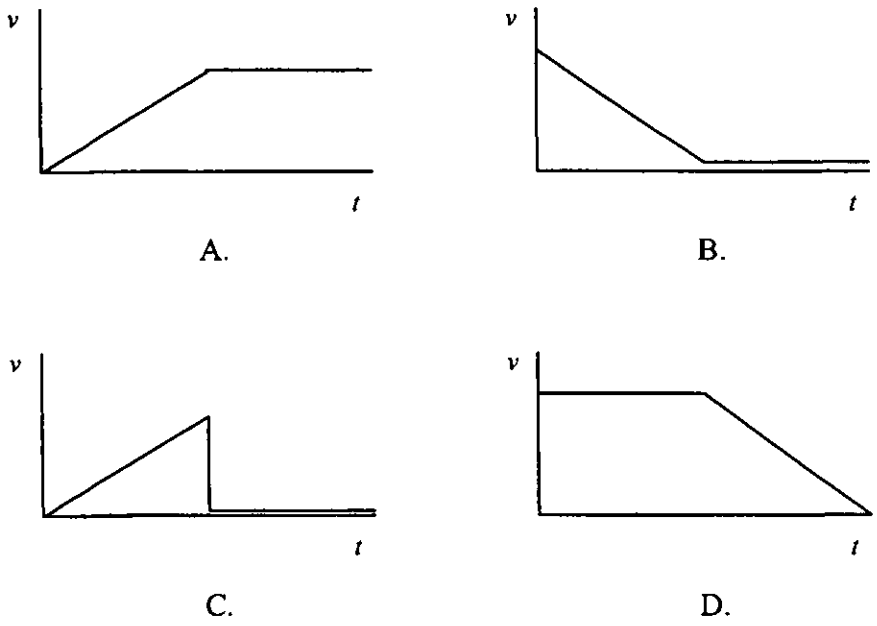
B. always in the same direction.

C. first in opposite directions and then in the same direction.

D. first in the same direction and then in opposite directions.

3. *Graph of motion on track sections.* A trolley runs from rest down a sloping track section onto a level section as shown. Friction is negligible.

Which velocity-time graph best represents the motion on both sections?



4. *Force at the top.* A ball is thrown vertically upwards. At the **top** of its path, what forces, if any, act on the ball?

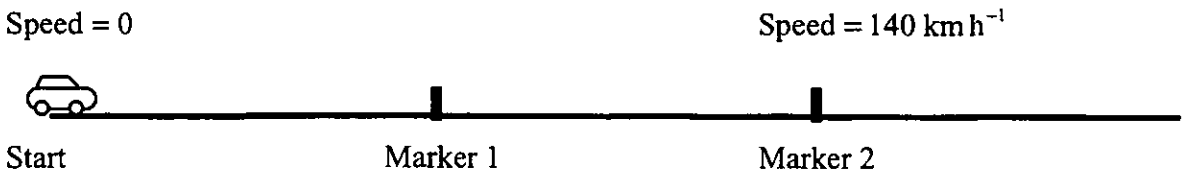
A. No forces

B. Only a downward force

C. Only an upward force

D. Both an upward and a downward force

5. *Acceleration on a marked track.* A racing car accelerates uniformly from rest along a straight track. The track has markers spaced at equal distances along it from the start, as shown below. The car reaches a speed of 140 $km\,h^{-1}$ as it passes Marker 2.



At what part of the track would the car have been travelling at an instantaneous speed of 70 $km\,h^{-1}$?

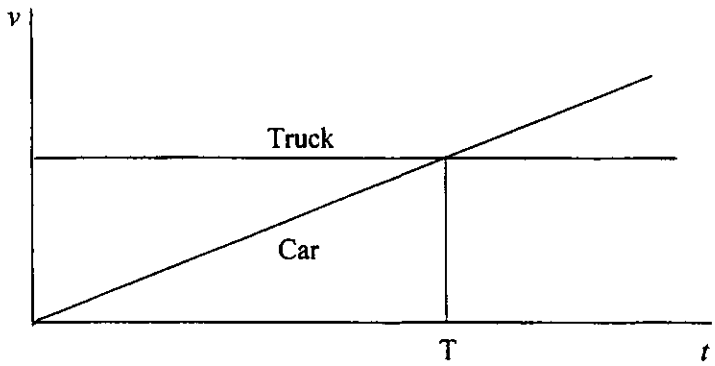
A. Before Marker 1

B. At Marker 1

C. Between Marker 1 and Marker 2

D. After Marker 2

6. *Motions of two vehicles.* The velocity-time graphs below represent the motions of a car and a truck which are initially alongside each other at time t = 0.



At time T, which one of the following is true of the distances travelled by the two vehicles since time t = 0?

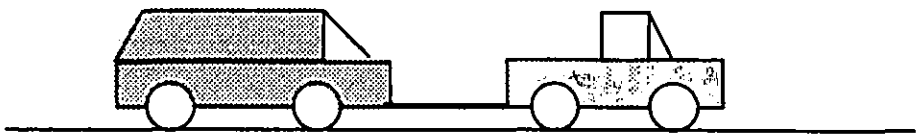
A. They will have travelled the same distance.

B. The truck will not have moved.

C. The car will have travelled further than the truck.

D. The truck will have travelled further than the car.

7. *Acceleration while towing a van.* A small tow-truck is capable of a maximum acceleration 'a' on its own along a level road. It then tows a van of twice its own mass, as shown



Ignoring frictional effects, the maximum acceleration while towing the van will be

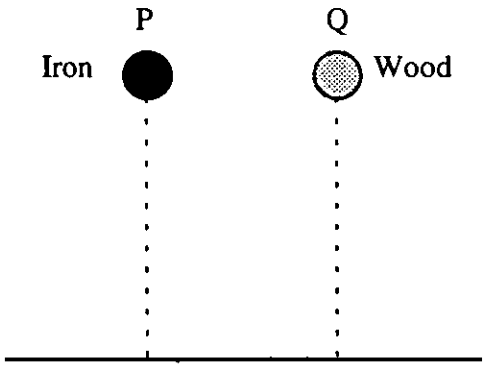
A. $\frac{a}{4}$

B. $\frac{a}{3}$

C. $\frac{a}{2}$

D. a

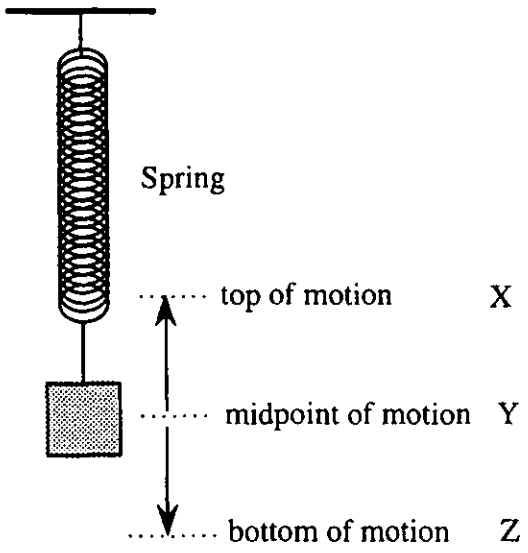
8. *Heavy and light balls falling.* A heavy iron ball P and a lighter wooden ball Q are dropped simultaneously from the same height above the floor. Air resistance is negligible.



Which of the following gives the correct observation **and** the correct explanation?

	OBSERVATION		EXPLANATION
A.	P reaches the floor first	**because**	the gravitational force on P is greater
B.	Q reaches the floor first	**because**	Q will have a greater acceleration, since it has a smaller mass.
C.	They reach the floor at the same time	**because**	the gravitational forces on P and Q are equal.
D.	They reach the floor at the same time	**because**	the ratio of gravitational force to mass is the same for P and Q.

9. *Force on an oscillating mass.* A mass oscillates up and down at the end of a spring. The extent of the motion of its centre of mass is indicated by the arrows.



At what point(s) of the motion is there a **zero** resultant force on the mass?

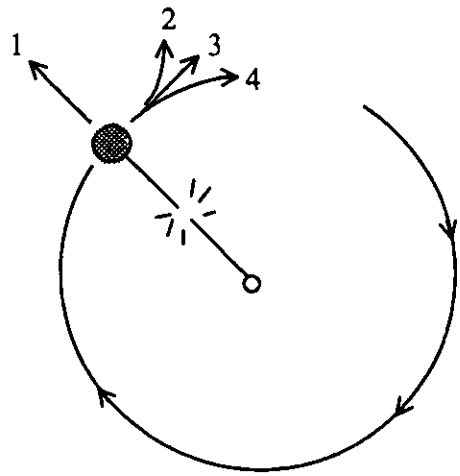
A. Only at the top (point X)

B. At the midpoint of the motion (point Y)

C. Only at the bottom (point Z)

D. At both the top (point X) and the bottom (point Z)

10. *String snaps during circular motion.* A puck (flat disc) is undergoing frictionless circular motion on a **horizontal** air table at the end of a string. The string snaps when the puck is in the position shown.



Top view of motion, which is in the horizontal plane

Which labelled path best represents the motion of the puck after the string snaps?

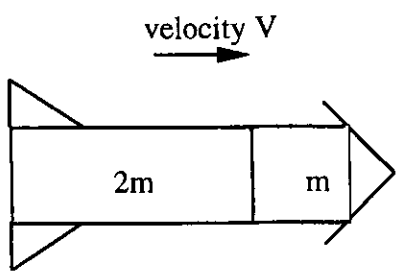
A. Path 1

B. Path 2

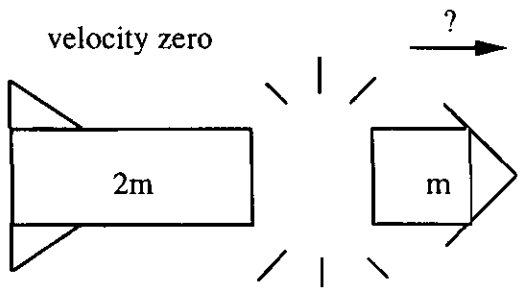
C. Path 3

D. Path 4

11. *Spacecraft separation.* A spacecraft is made up of a rear section of mass 2 m and a front section of mass m. as shown. It is travelling at velocity V relative to the earth. A device then fires to separate the two sections, after which the rear section has zero speed relative to the earth.



BEFORE SEPARATION



AFTER SEPARATION

The velocity of the front section after separation will be

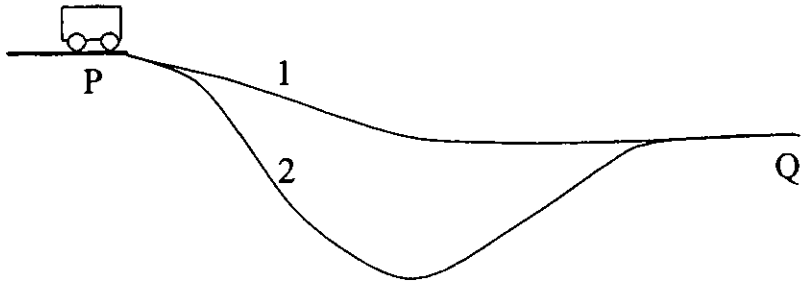
A. V

B. 2 V

C. 3 V

D. 4 V

12. *Speed after two alternative routes.* A trolley starts from rest at point P and can reach point Q on a lower level by either of two paths 1 or 2. Assume friction and air resistance are negligible.



How will the trolley's speed at point Q compare for the two paths?

A. Its speed at Q will be greater if it takes path 1.

B. Its speed at Q will be greater if it takes path 2.

C. Its speed at Q will be the same for both paths.

D. The comparative speeds depend on the extent of the dip.

13. *Molecular motion and phases of matter.* Molecules in matter are in motion

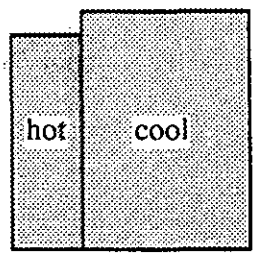
A. only in the gas phase.

B. only in the gas and liquid phases.

C. in the gas, liquid and solid phases.

D. in neither the gas, liquid or solid phases.

14. *Temperature changes of blocks in contact.* A small hot copper block is placed in thermal contact with a larger cool copper block.



How will the temperature **changes** of the two blocks compare in coming to thermal equilibrium? Assume negligible heat is lost to the surroundings.

A. The temperature changes of the blocks will be equal.

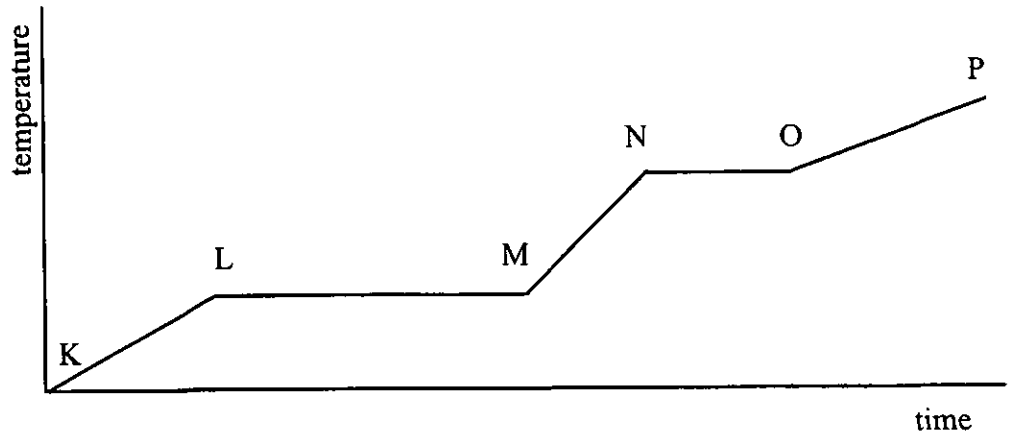
B. The temperature of the small block will change the most.

C. The temperature of the large block will change the most.

D. The temperature changes cannot be compared without more data about the blocks.

The following information relates to questions 15 and 16 below.

A substance is heated at a constant rate of energy transfer. A graph of its temperature against time is shown below.



15. *Mixture of two phases.* Which regions of the graph correspond to the substance existing in a mixture of two phases?

A. KL, MN and OP

B. LM and NO

C. All regions

D. No regions

16. *Greatest specific heat capacity.* In which region of the graph is the specific heat capacity of the substance greatest?

A. KL

B. LM

C. MN

D. OP

17. *Explanation of gas pressure increase.* When the volume of a gas is isothermally compressed to a smaller volume, the pressure exerted by the gas on the container walls increases. The best microscopic explanation for this pressure increase is that at the smaller volume

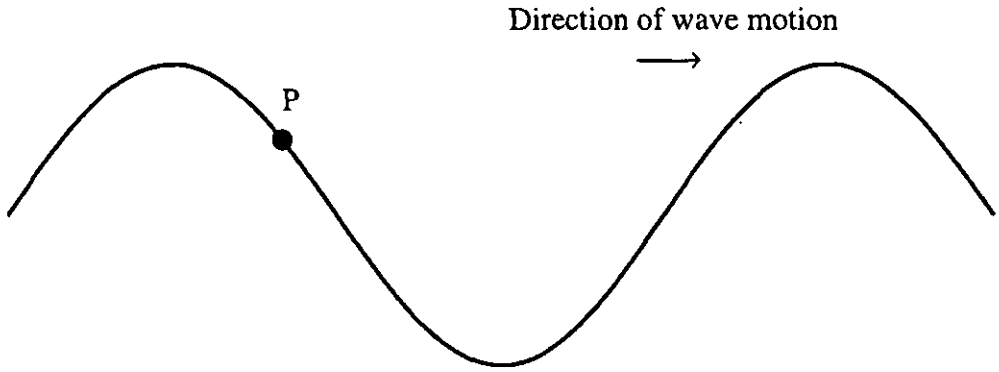
A. the individual gas molecules are compressed.

B. the gas molecules repel each other more strongly.

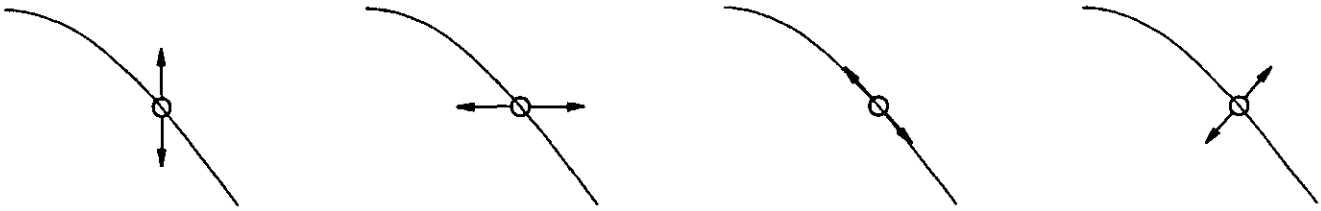
C. the average velocity of gas molecules hitting the walls is greater.

D. the frequency of collisions of gas molecules with the walls is greater.

18. *Transverse wave: motion of a rope segment.* The diagram represents a transverse wave travelling from left to right along a rope, at a particular instant of time.

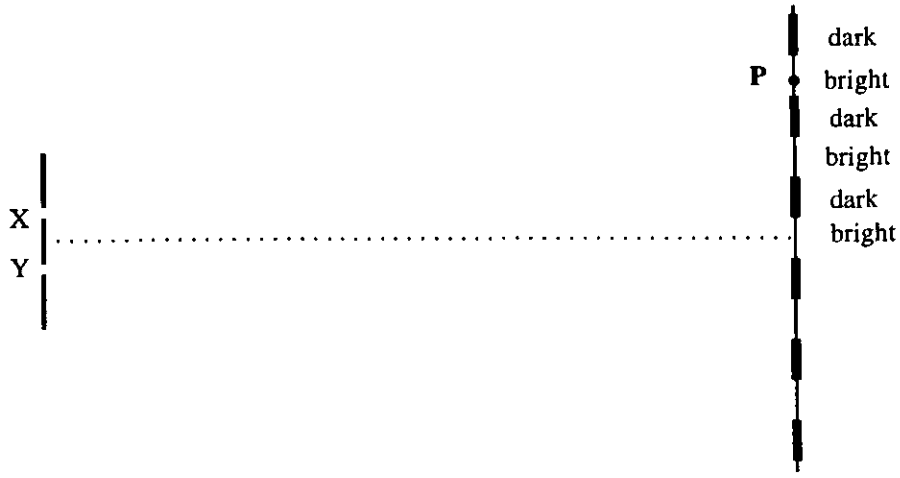


A segment of rope is marked P. Which diagram below best represents how P oscillates as the wave travels?



A. B. C. D.

19. *Path difference for double slit interference.* Coherent light of wavelength λ from two slits X and Y forms an interference pattern of light and dark fringes on a screen as shown.



For light coming from X and Y, what is the difference in path length to point P on the screen?

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

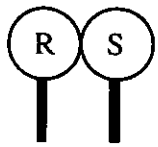
B. λ

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

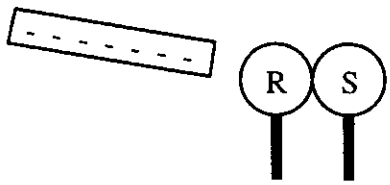
D. 2λ

20. *Electrostatic induction process for two spheres*

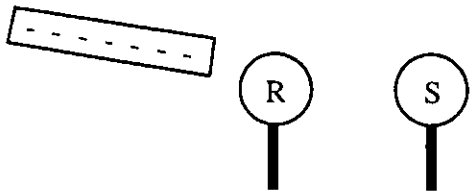
Two uncharged metal spheres R and S on insulating stands are touching as shown.



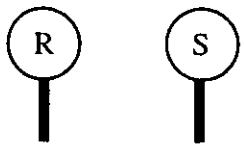
A negatively charged rod is brought close to R.



The spheres are then separated.



The charged rod is removed.



Which **one** of the following will be true after this process?

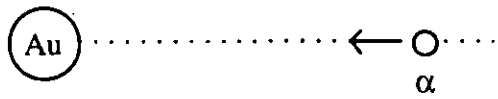
A. Neither R nor S will be charged.

B. R will be charged positively and S negatively.

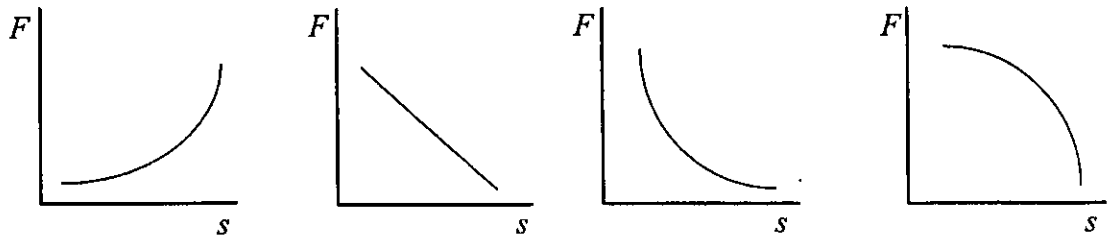
C. R will be charged negatively and S positively.

D. Both R and S will be positively charged.

21. *Force on an alpha particle approaching a nucleus.* An alpha particle approaches a gold nucleus along a straight line as shown in the sketch below.



Which of the following graphs best represents the variation in **electrostatic force** F experienced by the alpha particle as a function of its distance s from the centre of the nucleus?



22. *Electrostatic forces on two charged balls.* The diagram shows magnitude and direction of the electrostatic forces on two identically charged cork balls.

Suppose the charge on the **left** ball is now doubled. Which of the diagrams below best represents the forces that now act on the two balls?

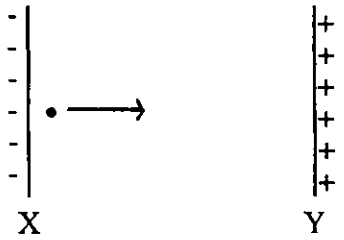
A.

B.

C.

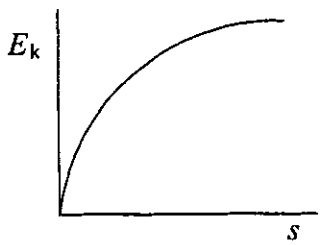
D.

23. *Energy of an electron moving between charged plates.* X and Y are two oppositely charged parallel plates in a vacuum. An electron starts from rest near plate X and moves toward plate Y.

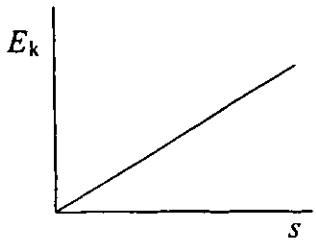


Which of the following graphs best represents the relationship between the kinetic energy E_k of the electron and the distance s moved from plate X?

A.

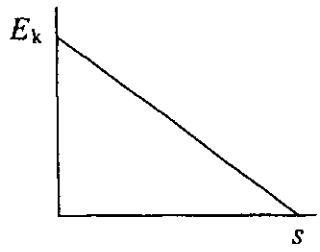


B.



C.

D.



24. *Resistance wire configurations.* A length of resistance wire (**Figure I**) has resistance R.

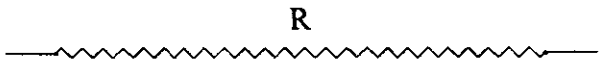


Figure I

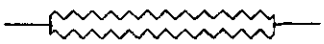


Figure II

If the wire is cut in half and the two pieces connected in a circuit as shown in **Figure II**, what will be the effective resistance?

A. $\frac{R}{4}$

B. $\frac{R}{2}$

C. 2R

D. 4R

25. *Battery current for lamps in series.* A battery is connected across a lamp. If a second identical lamp is then connected in **series** with the first, what will happen to the current through the battery?

A. It will decrease

B. It will remain the same

C. It will increase

D. It will become zero

26. *Electromagnetic induction.* Which one of the following is the best description of electromagnetic induction?

A. The production of a magnetic field by an electric current.

B. The production of an emf by a varying magnetic flux.

C. The force arising on an electric charge moving in a magnetic field.

D. The force arising on a current-carrying conductor in a magnetic field.

27. *Evidence for atomic energy levels.* Which one of the following phenomena suggests the existence of electron energy levels in atoms?

A. Alpha particle scattering

B. The existence of isotopes

C. Spectral lines

D. Radioactive decay

28. *Millikan experiment.* In a Millikan-type experiment, a tiny plastic sphere carrying charge Q remains stationary between parallel plates when there is a potential difference of 500 V between them. The sphere is replaced by another sphere of twice the mass and to keep it stationary the potential difference has to be adjusted to 2000 V.

What is the charge on the second sphere?

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

B. Q

C. 2Q

D. 4Q

29. *Radioactive decay product.* A radioactive nuclide of atomic number Z emits an electron followed by a gamma ray. What is the atomic number of the new nuclide?

A. Z – 4

B. Z – 2

C. Z – 1

D. Z + 1

30. *Activity after three half-lives.* After three half-lives have elapsed, the activity of a radioactive species will have diminished by a factor of

A. $\frac{3}{2}$

B. 3

C. 6

D. 8