G.C.E. (Advanced Level) Examination - August 2013

PHYSICS - II

Two hours

Instructions :
- This question paper consists **50** questions in **5** pages.
- Write your **Index Number** in the space provided on the answer sheet.
- Answer **all** the questions.
- Instructions are given on the back of the answer sheet. Follow them carefully.
- In each of the questions 1 to 50, pick one of the alternatives (1), (2), (3), (4), (5) which is **correct or most appropriate** and **mark your response on the answer sheet with a cross (×) in accordance with the instructions given in the back of the answer sheet.**

Use of calculators is not allowed.

$(g = 10\ N\ kg^{-1})$

01. SI unit of Planck constant is
(1) $J\ s^{-1}$ (2) $J\ s$ (3) $J\ K^{-1}$ (4) $J\ K$ (5) $J^{-1}\ s^{-1}$

02. Which of the following waves requires a physical medium for travelling?
(1) Light waves (2) Radio waves
(3) Sound waves (4) X - rays
(5) Gamma rays

03. Electromgnetic radiation of frequency f is incident on a photosensitive surface of which threshold frequency for emission of photoelectrons is f_0.
Which of the following is **not true?**
(1) No photoelectrons are emitted when $f < f_0$.
(2) f_0 is a characteristic feature of the material of the photosensitive surface.
(3) When $f > f_0$, the rate of the emission of photoelectrons increases as the intensity of incident radiation increases.
(4) The stopping potential is directly proportional to f^2.
(5) The stopping potential is independent of the intensity of the incident radiation.

04. Consider the following statements made regarding the speed of sound.
(A) The speed of sound in air increases with the increase of temperature of air.
(B) At a given temperature the speed of sound in a metal is higher than that in air.
(C) The speed of sound depends on the frequency of the sound wave.
Of the above statements
(1) only (A) is true (2) only (C) is true.
(3) only (A) and (B) are true (4) only (A) and (C) are true
(5) all (A), (B) and (C) are true

05. As shown in figure, a box is placed on an oil layer of viscosity η and thickness d. The area of the surface of the box in contact with the oil is A. What should be the horizontal force F to be applied non the box in order to move it at a constant velocity v?

(1) $F = \frac{\eta A d}{v}$ (2) $F = \frac{\eta A v}{d}$
(3) $F = \frac{\eta v}{dA}$ (4) $F = 6\pi\eta A v d$
(5) $F = 6\pi v A \eta$

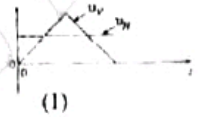
06. A slow neutron is absorded by a $^{235}_{92}U$ nucleus and results in a fission process as follows.

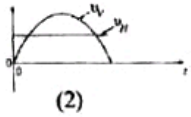
$$^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{139}_{56}Ba + {}^{94}_{36}Kr + x\ {}^{1}_{0}n$$

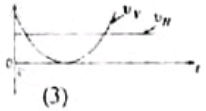
The value of x (number of neutrons produced) of the above fission process is
(1) 1 (2) 2 (3) 3 (4) 4 (5) 5

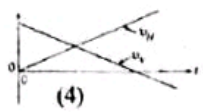
07. If the mean output pressure of the heart is 1.2×10^4 Pa and the mean blood flow rete is $5.0 \times 10^{-3}\ m^3$ per minute, the mean output power of the heart is
(1) 0.5 W (2) 1.0 W (3) 1.5 W (4) 2.0 W (5) 2.5 W

08. An object is projected under gravity with velocity u, in a direction which makes an angle θ with the horizontal as shown in the figure. Which of the following graphs correctly indicates the variation of the horizontal (v_H) and vertical (v_V) components of the velocity of the object with time (t)?


(1)


(2)


(3)


(4)


(5)

09. Two athletes run a 10 km race with constant speeds v_1 and v_2 in a circular track of radius 50 m. It has been observed that the athlete with speed v_1 completed 10 rounds when the other athlete completed 9 rounds. The ratio $\frac{v_1}{v_2}$ is
(1) $\frac{10}{9}$ (2) $\frac{9\pi}{10}$ (3) $\frac{18\pi}{10}$ (4) $\frac{10\pi}{9}$ (5) 9

10. Two wheels A and B of a machine rotate about a common axis in the same direction with angular speeds ω_1 and ω_2, respectively. See figure (a). Moment of inertia of wheel A about the axis of rotation is I_1 and that of wheel B is I_2. At a certain instant, two wheels are pushed towards each other until they are firmly pressed and the system rotates with a common angular speed ω, without slipping. See figure (b). The value of w is given by

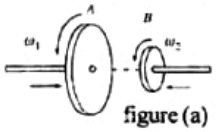


figure (a)

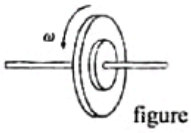


figure (b)

(1) $\omega = \frac{\omega_1 + \omega_2}{2}$ (2) $\omega = \frac{I_1\omega_1 + I_2\omega_2}{I_1 + I_2}$

(3) $\omega = \sqrt{\omega_1\omega_2}$ (4) $\omega = \frac{I_1\omega_1 + I_2\omega_2}{I_1 - I_2}$

(5) $\omega = \frac{I_1\omega_1^2 + I_2\omega_2^2}{\omega_1^2 + \omega_2^2}$

11. A block of mass m, kept on the horizontal truck-bed, is at rest with respect to the truck when it is moving horizontally with a constant acceleration a. The coefficient of static friction between the truck-bed and the mass is μ. The frictional force acting on the mass is given by

(1) ma (2) μma (3) $\mu m(g + a)$
(4) $\mu m(g - a)$ (5) mg

12. A simple pendulum is constructed by suspending a small metal bob with a fine wire of the same metal. The period of the pendulum at temperature θ_1 is T_1. When the pendulum operates at a higher temperature of θ_2 the period of the pendulum would be (Linear expansivity of the metal is α)

(1) $T_1\sqrt{1 + \alpha(\theta_2 - \theta_1)}$ (2) $T_1\sqrt{\frac{1}{1 + \alpha(\theta_2 - \theta_1)}}$

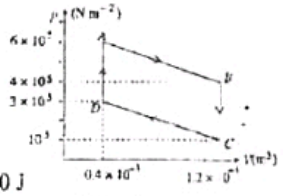
(3) $\frac{T_1}{1 + \alpha(\theta_2 - \theta_1)}$ (4) $[1 + \alpha(\theta_2 - \theta_1)]\ T_1$

(5) $T_1\sqrt{\alpha(\theta_2 - \theta_1)}$

13. The atoms of an ideal gas have a certain mean kinetic energy at 10 °C. Their mean kinetic energy will be twice at

(1) 20 °C (2) 100 °C (3) 293 °C
(4) 566 °C (5) 600 °C

14. A system undergoes a cyclic process according to the $P - V$ diagram shown in figure. The work done by the system from A to B and from B to C, respectively are



(1) 400 J, 0 (2) 400 J, 360 J
(3) 480 J, 360 J (4) 480 J, 0 (5) 520 J, 0

15. A stretched string is vibrating with four loops. If the frequency of vibration is increased by a factor of 2, the number of loops formed would be

(1) 3 (2) 5 (3) 6 (4) 7 (5) 8

16. Consider the following statements made about a compound microscope

(A) The object should be placed just outside the focal poind of the objective.
(B) The eyepiece acts as a simple magnifier.
(C) The angular magnification is independent of the focal length of the objective.

Of the above statements

(1) only (A) is true (2) only (A) and (B) are true
(3) only (B) and (C) are true (4) only (A) and (C) are true
(5) all (A), (B) and (C) are true.

17. 

(A) Incandescent (B) CFL (C) LED

The figure shows three types of electric bulbs (*A*), (*B*) and (*C*) which produce the same brightness spproximately. The consumptions of electric power by (*B*) and (*C*) when compared with (*A*) are approximately

(1) same as (A).
(2) $\frac{1}{10}$ and $\frac{1}{5}$ of (A), respectively.
(3) 10 times and 5 times of (A), respectively.
(4) $\frac{1}{6}$ and $\frac{1}{12}$ of (A), respectively.
(5) 6 times and 12 times of (A), respectively.

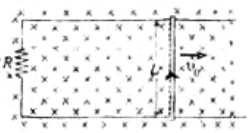
18. Consider the following statements made regarding a transformer

(A) The core of the transformer is made out of laminated plates of soft iron.
(B) Both Joule heating and eddy currents contribute to the energy loss of a transformer.
(C) Power can be amplified using a transformer.

Of the above statements

(1) only (A) is true (2) only (B) is true.
(3) only (A) and (B) are true. (4) only (B) and (C) are true.
(5) all (A), (B) and (C) are true.

19. A metal rod of mass M and length L is placed on a frictionless perallel horizontal rail in a magnetic field of flux density B directed into the paper as shown in figure. (The rail is a conductor and a resistor of value R is connected to the rail as shown.) If an initial velocity of v_0 is given to the rod released as shown, it will begin to move in the direction of v_0, with an acceleration of



(1) $-\frac{BLv_0^2}{MR}$ (2) $\frac{RB^2L^2v_0^2}{M}$

(3) $\frac{B^2Lv_0}{MR}$ (4) $-\frac{B^2L^2v_0}{MR}$

(5) $-\frac{MBLv_0}{R}$

20. Sound that has an intensity level of 100 dB is how many times more intense than sound of intensity level 20 dB?

(1) 5 (2) 8 (3) 10^3 (4) 10^5 (5) 10^8

21. The minimum velocity υ that a particle should have in order to escape from a planet of mass M and radius R is given by

(1) $\upsilon = \sqrt{\frac{2GM}{R}}$ (2) $\upsilon = 2\sqrt{\frac{GM}{R}}$

(3) $\upsilon = 4\sqrt{\frac{gM}{R}}$ (4) $\upsilon = \frac{GM}{R}$

(5) $\upsilon = \frac{2GM}{R}$

22. A child, swinging a swing, hears a sound from a stationary whictle loctated in the direction where he is facing as shown in figure. The minimum and maximum frequencies of the sound heard by him are 1314Hz and 1326 Hz respectively. If the speed of sound in air is 330 m s^{-1} and air remains still, what is the wavelength of the sound emitted from the whistle?

(1) 12.5 cm (2) 24.8 cm (3) 25.0 cm
(4) 25.2 cm (5) 50.0 cm

23. A person suffering from farsightedness has his near point located at 150 cm from the eyes. After wearing contact lenses, he could read clealy a book held at a distance of 25 cm. The used contact lenses are
(1) concave lenses with 21.7 cm focal length.
(2) convex lenses with 21.7 cm focal length.
(3) concave lenses with 30.0 cm focal length.
(4) convex lenses with 30.0 cm focal length.
(5) convex lenses with 60.0 cm focal length.

24. A prism is placed on the prism table of a properly adjusted spectrometer and the refracted image of the illuminated collimator slit is observed while rotating the prism table starting from a large angle of incidence towards smaller angles. As the prism table rotates.
(1) the image will move in a direction with continuously decreading angle of deviation.
(2) the image will move in a direction with continuously increasing angle of deviation.
(3) the image will move in a direction wing increasing angle of deviation, turn back, and move in a direction with decreasing angle of deveiation.
(4) the image will first move in a direction with decreasing angle of deviation, turn back, and move in a direction with increasing angle of deviation.
(5) the image will first move in a direction with decrasing angle of deviation and then stop.

25. A lighted candle is placed in front of a convex lens as shown in figure (a).

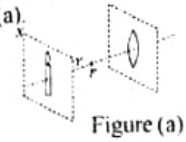


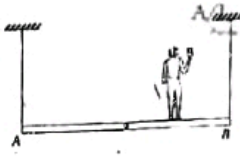
Figure (a)

Figure (b)

If the flame bends towards the direction Y due to wind as shown in figure (b), which of the following shows the nature of the image of the candle and the flame?

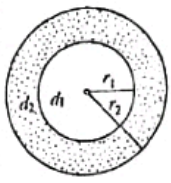
(1) (2) (3) (4) (5)

26. A man of mass 60 kg standing on a uniform wooden rafter hung horizontally by two identical ropes is painting a wall. The mass of the rafter is 20 kg. What is the **minimum** tension that should be withheld by each rope so that the man can move safaly between A and B?



(1) 100 N (2) 400 N (3) 600 N
(4) 700 N (5) 800 N

27. The inner sphere of a composite solid spherical object is made of a material of density d_1 and the rest of the composite spgere is made of a material of density d_2 as shown in figure. The radius of the inner sphere is r_1 and the radius of the composite sphere is r_2. If the composite sphere floats fully immersed in a liquid of density d_3, then

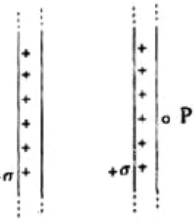


(1) $r_2^3 d_3 = r_1^3 d_1 + r_2^3 d_2 - r_1^3 d_2$ (2) $r_1^3 d_1 = r_2^3 d_2 + r_2^3 d_3 + r_1^3 d_2$

(3) $r_2^2 d_2 = r_1^2 d_1 + r_2^2 d_1 - r_2^2 d_2$ (4) $r_2^2 d_3 = r_1^2 d_1 + r_2^2 d_2 - r_1^2 d_2$

(5) $r_2^3 d_2 = r_1^3 d_1 + r_1^3 d_3 - r_1^3 d_2$

28. Two large non-conducting plane sheets, each having a uniform surface charge density $+\sigma$ on one side, are situated parallel to each other as shown. The electric field intensity at a point P is

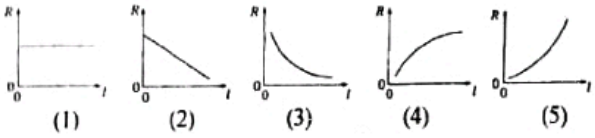


(1) $\frac{2\sigma}{\varepsilon_0}$ (2) $\frac{\sigma}{\varepsilon_0}$ (3) $\frac{\sigma}{2\varepsilon_0}$

(4) $\frac{\sigma}{4\varepsilon_0}$ (5) 0

29. Consider the following statements made about electric fields and equipotential surfaces.
(A) Electric field lines and equipotential surfaces are always perpendicular to each other.
(B) The magnitude of the electric field intensity should be same at all points on an equipotential surface.
(C) The magnitude of the electric field intensity cannot be zero at a point on an equipotential surface.
Of the above statements,
(1) only (A) is true (2) only (B) is true
(3) only (A) and (B) are true (4) only (B) and (C) are true
(5) all (A), (B) and (C) are true

30. If a piece of uniform wire is stretched gradually, which of the following curves correctly indicates the variation of its resistance R with the length l?



(1) (2) (3) (4) (5)

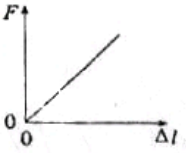
31. A wire bent into the shape of a semicircle forms a closed loop and carries a current I as shown in figure. The loop lies in the XY plane and a uniform magnetic field is present along the Y direction. Which of the following is true regarding the forces acting on the circular and straight portions of the loop due to the magnetic field?

	Force on the circular portion	Force on the straight portion
(1)	zero	into the paper
(2)	zero	out of the paper
(3)	into the paper	into the paper
(4)	into the paper	out of the paper
(5)	out of the paper	into the paper

32. Small amount of powdered pepper was sprinkled on the surface of water in a cup and the water surface was touched with a clean ary finger tip. Then the finger tip was mbbed with a little soap and the same process was repeated. Which of the following observation is likely to be seen in the above processes?

	Cleaned and dried finger tip	Soapy finger tip
(1)	Pepper powder tend to move away from the finger tip.	Pepper powder tend to flock around the finger tip.
(2)	Pepper powder tend to move away from the finger tip.	Pepper powder tend to move away from the finger tip.
(3)	Nothing happens to the distribution of pepper powder.	Pepper powder tend to flock around the finger tip.
(4)	Nothing happens to the distribution of pepper powder.	Pepper powder tend to move away from the finger tip.
(5)	Pepper powder tend to flock around the finger tip.	Pepper powder tend to flock around the finger tip.

33. The applied force F and extension Δl curve for a metal wire is shown in figure. Consider the following statements.



(A) If another wire of lower cross-sectional area is used without changing other parameters, the corresponding curve would fall above the curve shown in figure.

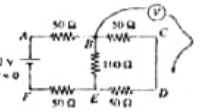
(B) If a wire having identical parameters but with a larger Young's Modulus is used then the corresponding curve would fall below the curve shown is figure.

(C) If a longer wire is used without changing the other parameters the corresponding curve would fall below the curve shown in figure.

Of the above statements

(1) only (A) is true. (2) only (C) is true
(3) only (A) and (B) are true. (4) only (B) and (C) are true.
(5) all (A), (B) and (C) are true.

34. One terminal of the voltmeter V shown in figure is connected to the point B. When the voltages of all the other points labelled with English letters are measured by connecting the free terminal of the voltmeter to those points, the **magnitudes** of the readings indicated by the voltmeter



(1) 0, 2V, 8V (2) 4V, 6V
(3) 2V, 4V, 8V (4) 0, 6V, 8V
(5) 4V, 8V, 12V

35. By looking at an empty glass vessel along the path shown by the broken ling in figure, a person could see the left corner of the bottom of the glass vessel. After the glass vessel is filled with a clear liquid the person could see the **middle** of the bottom of the glass vessel when looking along the same path. The refractive index of the liquid is (Take $\sqrt{13} = 3.6$)

(1) 1.11 (2) 1.22 (3) 1.33 (4) 1.44 (5) 1.55

36. The initial relative humidity of a closed room of volume V at room temperature θ_0 is X%. The temperature and the relative humidity of the room are then reduced to θ_1 and Y% respectively using an airconditioner. If the absolute humidities of air at corresponding dew points of θ_0 and θ_1 are A_0 and A_1 respectively then the mass of water vapour that has been removed by the airconditioner is

(1) $\left(\frac{XA_0V - YA_1V}{100}\right)$ (2) $\left(\frac{XA_0}{V} - \frac{YA_0}{V}\right)100$

(3) $\left(\frac{X}{A_0V} - \frac{Y}{A_1V}\right)\frac{1}{100}$ (4) $\left(\frac{XV}{A_0} - \frac{YV}{A_1}\right)100$

(5) $\left(\frac{A_0V}{X} - \frac{A_1V}{Y}\right)100$

37. When a uniform rod of known length and area of cross-section was lagged, and the rate of rlow of heat and the temperature gradient were measured, it was found that value of the thennal conductivity calculared using those quantiries, is smaller than the expected value of the thermal conductivity for the material of the rod. This could occur if

(A) the measured value of the rate of flow of heat through the rod is lower than the expected valne.

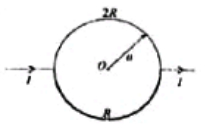
(B) lagging of the rod is poor

(C) the measunred value of the temperature gradient in larger than the expected value.

Of the reasons given above

(1) only (A) is true. (2) only (B) is true.
(3) only (B) and (C) are true. (4) only (A) and (C) are true.
(5) all (A), (B) and (C) are true.

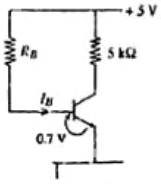
38. Lower half of the circular wire loop of radius a, shown in figure is made of a wire of resistance R and the upper half with a wire of resistance $2R$. The magnetic flux density at the center (O) of the wire loop is given by



(1) $\frac{\mu_0 I}{4a}$ (2) $\frac{\mu_0 I}{6a}$ (3) $\frac{\mu_0 I}{12a}$

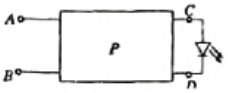
(4) $\frac{\mu_0 I}{16a}$ (5) $\frac{\mu_0 I}{18a}$

39. In the circuit shown I_B = 500 μA and the transistro has a current gain, β of 100. Current through the 5 kΩ resistor in approximately

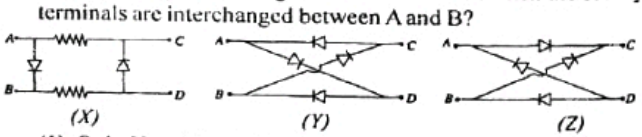


(1) 0.5mA (2) 1.0mA (3) 2.0mA
(4) 5.0mA (5) 50.0mA

40. The box P shown contains a circuit and when a battery is connected between A and B, the Light Emitting Diode (LED) connected to the circuit is lit.



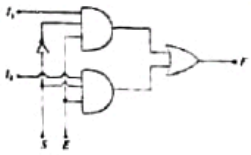
Which of the following circuit/ circuits inside the box P enables/ enable the Light Emitting Diode to be lit even when the battery terminals are interchanged between A and B?



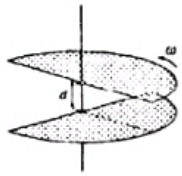
(X) (Y) (Z)

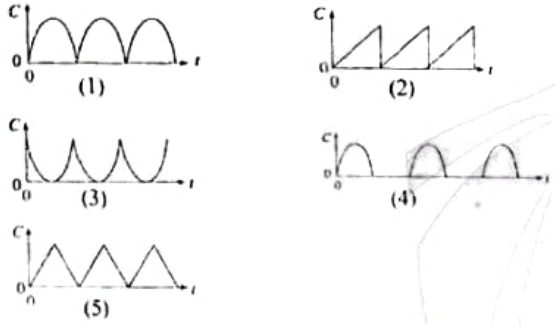
(1) Only X and Y (2) Only Y and Z (3) Only X and Z
(4) Only Y (5) Only Z

41. Consider following statements made about the circuit shown in figure.
(A) When E = 1 and S = 0, the output F = I_1
(B) When E = 1 and S = 1 the output F = I_2
(C) When E = 0 the output F = 0 irrespective of the values of S, I_1 and I_2.
Of the above statements
(1) only (C) is true
(2) only (A) and (B) are true
(3) only (B) and (C) are true
(4) only (A) and (C) are true
(5) all (A), (B) and (C) are true.



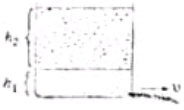
42. A variable parallel plate capacitor is made of two identical semi-circular matal plates that can be rotated about the common axis passing through the centres of each plat and perpendicular to them, as shown in the figure. If one plate rotates with constant angular speed ω, relative to the other, the variation of the capacitance C of the capacitor with time t is best represented by





43. One end each of two identical, stretched springs are fixed to the two ends of a closed tube and the other ends of the springs are attached to a mass m, as shown in the figure. Which of the following motion/s of the system results in a displcement of mass m towards P from the centre of the tube?
(A) Uniform acceleration of the tube in the direction of PQ, keeping the tube in a horizontal
(B) Rotation of the tube around a vertical axis passing through Q, keeping the tube in a horizontal plane.
(C) Vertical motion of the tube under gravity keeping Q below P.
(1) (A) only (2) (A) and (B) only
(3) (B) and (C) only (4) (A) and (C) only
(5) All (A), (B) and (C)

44. A cylindrical tank having a very large diameter contains two immiscible liquids of denities d_1 and d_2 ($d_1 > d_2$). The tank has a small hole closer to the bottom (see figure.)
If the heights of the liquids at a certain instant, are h_1 and h_2 what will be the speed υ of the liquid ejecting out of the tank at that instant? Neglect the surface tension effects and assume that the liquids are **non**-viscous.

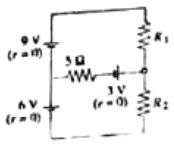


(1) $\upsilon = \sqrt{2gh_1}$ (2) $\upsilon = \sqrt{\frac{2gh_1d_1}{d_2}}$

(3) $\upsilon = \sqrt{2g(h_1 + h_2)}$ (4) $\upsilon = \sqrt{2g\left(\frac{d_1}{d_2}h_1 + h_2\right)}$

(5) $\upsilon = \sqrt{2g\left(h_1 + \frac{d_2}{d_1}h_2\right)}$

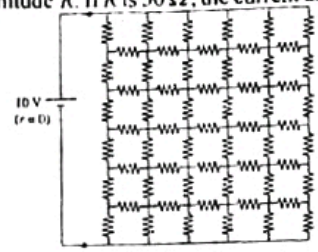
45. If no current flows through the 5 Ω resistor in the circuit shown, what is the value of ratio $\frac{R_1}{R_2}$?



(1) $\frac{2}{5}$ (2) $\frac{3}{5}$ (3) $\frac{2}{3}$

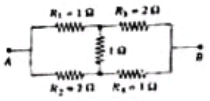
(4) 1 (5) $\frac{3}{2}$

46. The network shown in figure consists of identical resistors each having magnitude R. If R is 50 Ω, the current drawn from the cell is



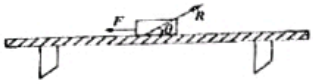
(1) 0.01A (2) 0.1A (3) 0.2A
(4) 0.5A (5) 1.0A

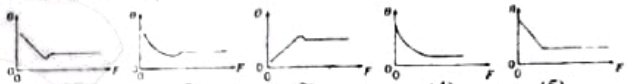
47. If a certain potential difference V is applied between A and B, a current of 3 A flows through R_1 and a current of 2 A flows through R_2.
What is the equivalent resistance between A and B?



(1) $\frac{4}{3}\Omega$ (2) $\frac{7}{5}\Omega$ (3) $\frac{3}{2}\Omega$ (4) 6Ω (5) 7Ω

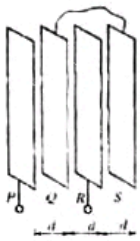
48. A box, which is placed on a rough, horizontal surface of a table is pulled by a variable, horizontal force of magnitude F.
For a given value of F the resultant force R exerted by the surface on the box makes an angle θ with the horizontal direction as shown in the figure. The variation of θ with F is best represented by





(1) (2) (3) (4) (5)

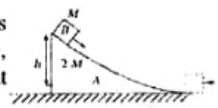
49. Four identical rectangular metal plates, P, Q, R and S have been arrenged parallel to each other so that the distance between two successive plates is d. Area of each plate is A. If the plates Q and S are connected by a thin metal wire, what will be the capacitance between platse P and R?



(1) $\frac{\varepsilon_0 A}{3d}$ (2) $\frac{2\varepsilon_0 A}{3d}$ (3) $\frac{3\varepsilon_0 A}{2d}$

(4) $\frac{2\varepsilon_0 A}{d}$ (5) $\frac{3\varepsilon_0 A}{d}$

50. A body A of mass 2M shown in figure is placed on a smooth horizontal surface, and a small block B of mass M is placed at the top of the body. Staring from rest, block B slides down on the smooth surface of A. At the instant when block B leaves A the speed υ of A is given by



(1) $\upsilon = \sqrt{2gh}$ (2) $\upsilon = \sqrt{gh}$ (3) $\upsilon = \sqrt{\frac{gh}{2}}$

(4) $\upsilon = \sqrt{\frac{gh}{3}}$ (5) $\upsilon = \sqrt{\frac{gh}{5}}$