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STPM 2006

**PHYSICS (FIZIK)
PAPER 1 (KERTAS 1)
MULTIPLE-CHOICE (ANEKA PILIHAN)**
One hour and forty-five minutes (Satu jam empat puluh lima minit)

PEJABAT PELAJARAN DAERAH MUAR**TRIAL EXAM
(PEPERIKSAAN PERCUBAAN)****Instructions to candidates:****DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.**

*There are **fifty** questions in this paper. For each question, four suggested answers are given. Choose one correct answer and indicate it on the multiple-choice answer sheet provided.*

Read the instructions on the multiple-choice answer sheet very carefully.

*Answer **all** questions. Marks will not be deducted for wrong answers.*

A Data Booklet is provided.

Arahan kepada calon:**JANGAN BUKA BUKU SOALAN INI SEHINGGA ANDA DIBENARKAN BERBUAT DEMIKIAN.**

*Ada **lima puluh** soalan dalam kertas ini. Bagi setiap soalan, empat cadangan jawapan diberikan. Pilih **satu** jawapan yang betul dan tandakan jawapan itu pada helaian jawapan aneka pilihan yang dibekalkan.*

Baca arahan pada helaian jawapan aneka pilihan itu dengan teliti.

*Jawab **semua** soalan. Markah tidak akan ditolak bagi jawapan yang salah.*

Buku data dibekalkan.

This question paper consist of 19 printed pages and 0 blank page.
(Kertas soalan ini terdiri daripada 19 halaman bercetak dan 0 halaman kosong)

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*Kertas soalan ini SULIT sehingga peperiksaan kertas ini tamat.

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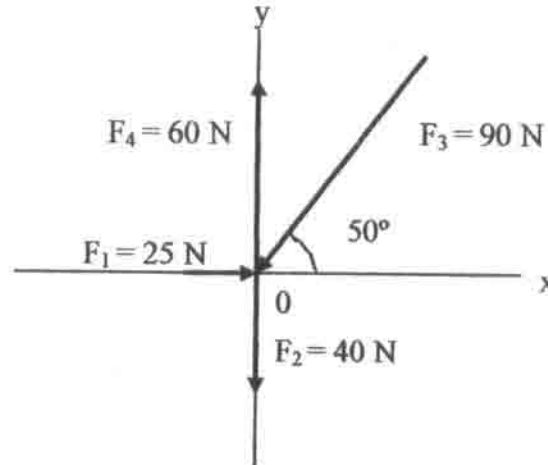
1. The frequency of the vibration f of a mass m at the end of the spring that has a stiffness constant k is related to m and k by a relation of the form $f = (\text{constant}) m^a k^b$. Use dimensional analysis to find a and b . It is known that $[f] = [T]^{-1}$ and $[k] = [M] [T]^{-2}$.

	a	b
A	-1	1
B	$-\frac{1}{2}$	$\frac{1}{2}$
C	$\frac{1}{2}$	$-\frac{1}{2}$
D	$\frac{1}{2}$	$-\frac{1}{2}$

2. Which of the following quantities does not have dimension Θ ?

- A Heat change
- B Molar heat capacity
- C Magnetic flux density
- D Change in internal energy

3. Find the resultant of the coplanar force system shown in figure below.



- A 58.9 N, below $-x$ axis
- B 58.9 N, below $+x$ axis
- C 61.3 N, below $-x$ axis
- D 61.3 N, below $+x$ axis

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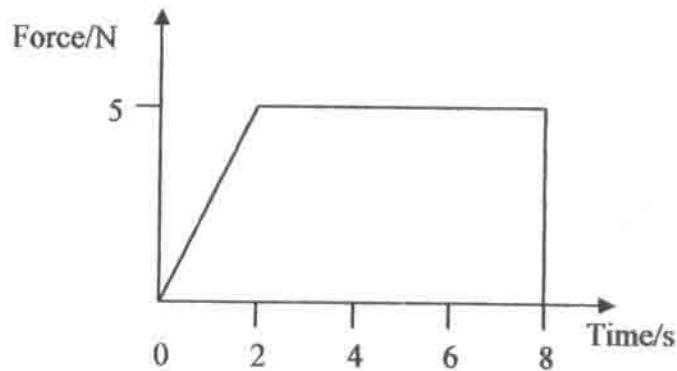
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4. A marble traveling at 100 cm s^{-1} rolls off the edge of a level table. If it hits the floor 30 cm away from the spot directly below the edge of the table, how high is the table?

- A 42.1 cm
- B 44.1 cm
- C 46.1 cm
- D 48.1 cm

5. A body with a mass of 3 kg experiences a force which varies according to time t as shown by the diagram below.



What is the momentum of the body at time $t = 8$ seconds?

- A 15 N
- B 25 N
- C 35 N
- D 50 N

6. The coefficient of kinetic friction between a 20 kg box and the floor is 0.40. How much work does a pulling force do on the box in pulling it 8.0 m across the floor at constant speed? The pulling force is directed 37° above the horizontal.

- A 284 J
- B 482 J
- C 824 J
- D 842 J

7. Compute the power output of a machine that lifts a 500 kg crate through a height of 20 m in a time of 60 s.

- A 1.63 kW
- B 16.3 kW
- C 5.88 kW
- D 58.8 kW

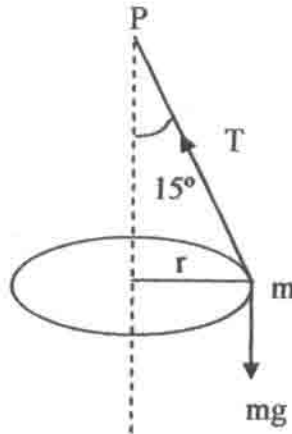
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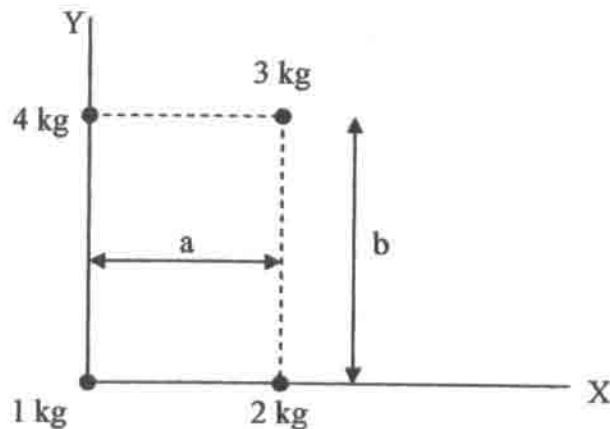
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8. A small ball is fastened to a string 24 cm long and suspended from a fixed point P to make a conical pendulum as shown in figure below. The ball describes a horizontal circle about a centre vertically under point P, and the string makes an angle of 15° with the vertical. Find the speed of the ball.



- A 40.4 cms^{-1}
 B 4.4 cms^{-1}
 C 0.4 cms^{-1}
 D 24.4 cms^{-1}

9. Four particles, of masses 1 kg, 2 kg, 3 kg, and 4 kg, are at the vertices of a rectangle of sides a and b (see figure below). If $a = 1 \text{ m}$ and $b = 2 \text{ m}$, find the location of the centre of mass.



- A $X_{cm} = 1.4 \text{ m}, Y_{cm} = 0.5 \text{ m}$
 B $X_{cm} = 0.5 \text{ m}, Y_{cm} = 0.5 \text{ m}$
 C $X_{cm} = 1.4 \text{ m}, Y_{cm} = 1.4 \text{ m}$
 D $X_{cm} = 0.5 \text{ m}, Y_{cm} = 1.4 \text{ m}$

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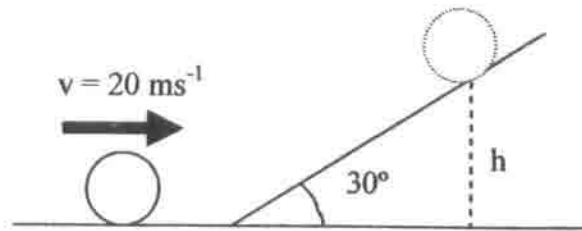
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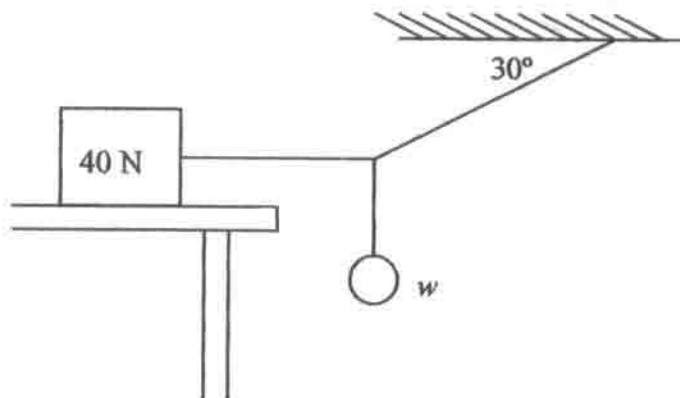
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10. As shown in figure below, a uniform solid sphere rolls on a horizontal surface at 20ms^{-1} . It then rolls up the incline shown. If friction losses are negligible, what will be the value of h where the ball stops?



- A 2.8 m
- B 8.8 m
- C 28.6 m
- D 26.8 m

11. The system of figure below is in equilibrium. What is the maximum value that w can have if the friction force on the 40 N block cannot exceed 12.0 N?



- A 6.92 N
- B 3.33 N
- C 9.62 N
- D 6.66 N

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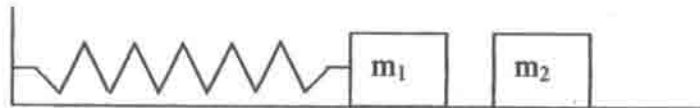
12. Where must a 800 N weight be hung on a uniform, 100 N pole so that the boy at one end supports one-third as much as a man at the other end?

- A The load should be hung 0.42 of the way from the boy to the man
- B The load should be hung 0.42 of the way from the man to the boy
- C The load should be hung 0.22 of the way from the boy to the man
- D The load should be hung 0.22 of the way from the man to the boy

13. A mass $m_1 = 1$ kg weight one-sixth as much on the surface of the moon as on the earth. Calculate the mass m_2 of the moon. The radius of the moon is 1.738×10^6 m.

- A 6.7×10^{22} kg
- B 7.4×10^{22} kg
- C 7.8×10^{23} kg
- D 8.4×10^{23} kg

14. The masses in figure below slide on essentially frictionless table. m_1 but not m_2 is fastened to the spring. If now m_1 and m_2 are pushed to the left so that the spring is compressed a distance d , what will be the amplitude of the oscillation of m_1 after the spring system is released.



- A $d \sqrt{\frac{m_1}{m_1 + m_2}}$
- B $d \sqrt{\frac{m_2}{m_1 + m_2}}$
- C $d \sqrt{\frac{m_1}{m_1 - m_2}}$
- D $d \sqrt{\frac{m_1}{m_2 - m_1}}$

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15. A closed tube X and an open tube Y have equal lengths. If the sound waves of frequency 400 Hz move in air with speed 320 m s^{-1} . What is the phase difference between two points separated by a distance 0.2 m in the direction of the motion?

- A $\pi/4$ rad B $\pi/2$ rad C $2\pi/5$ rad D $4\pi/5$ rad

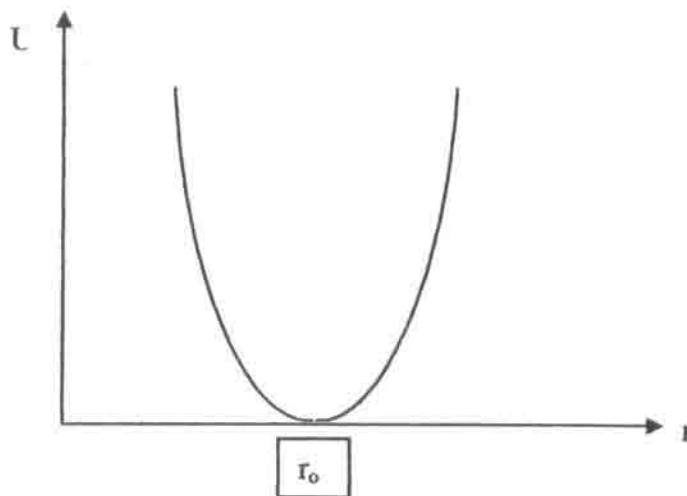
16. If the end correction effect can be neglected, the ratio first overtone for tube X / first overtone for tube Y when air is blown across the open end of the tube is

- A 1 : 4 B 2:3 C 3:2 D 3:4

17. A beat of frequency 7 Hz is detected when a musical note is sounded simultaneously with a tuning fork of frequency 438 Hz. If the same musical note is sounded with another tuning fork of 440 Hz, the beat frequency that is detected is more than 7 Hz.. The frequency of the musical note is

- A 431 Hz B 433 Hz C 439 Hz D 445 Hz

18. The diagram below shows the variation of potential energy U between two atoms in a solid against separation r between the atoms around the equilibrium distance r_0 .



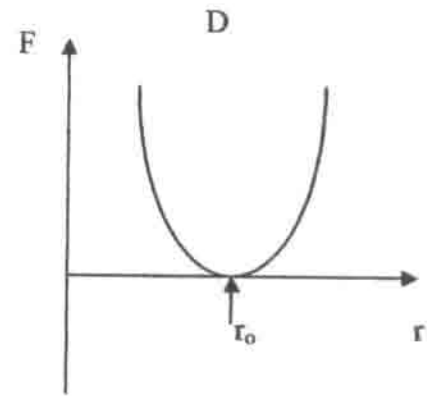
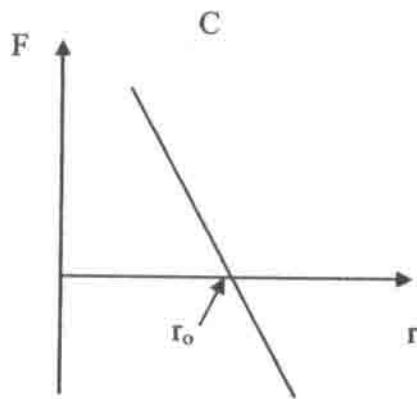
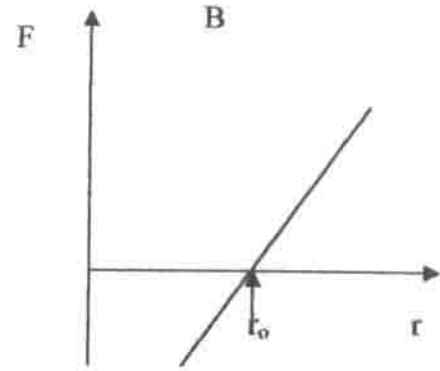
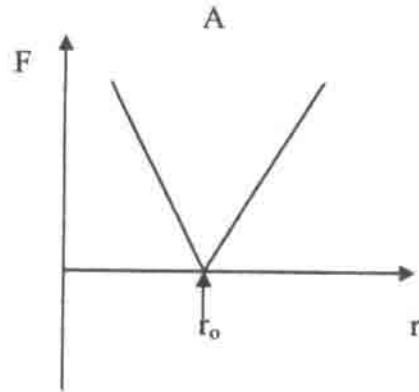
If $U \propto (r-r_0)^2$, which of the following graphs represent the variation force F against separation r .

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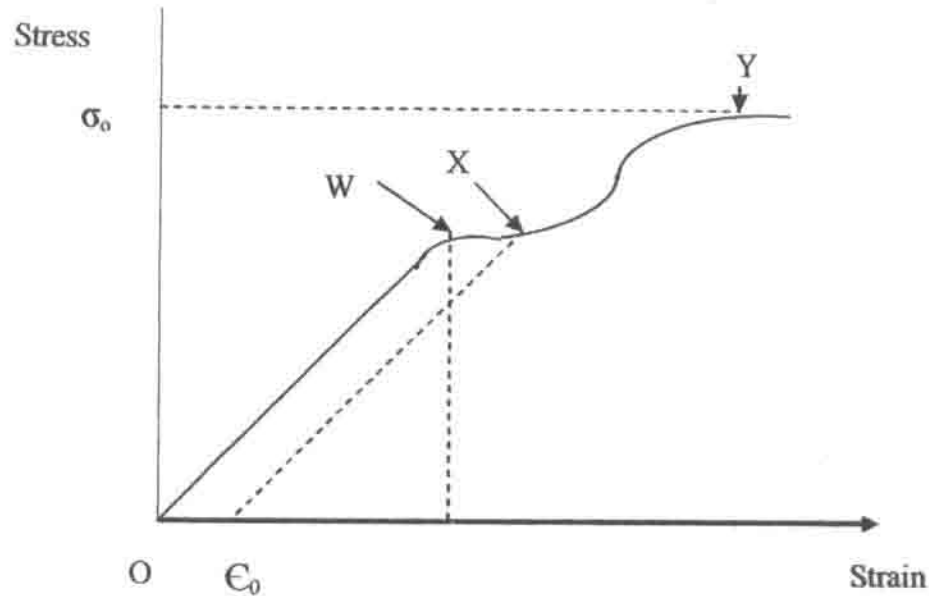
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19. The behaviour of a wire when stretched by a longitudinal force is represented by the graph of stress against strain as shown below.

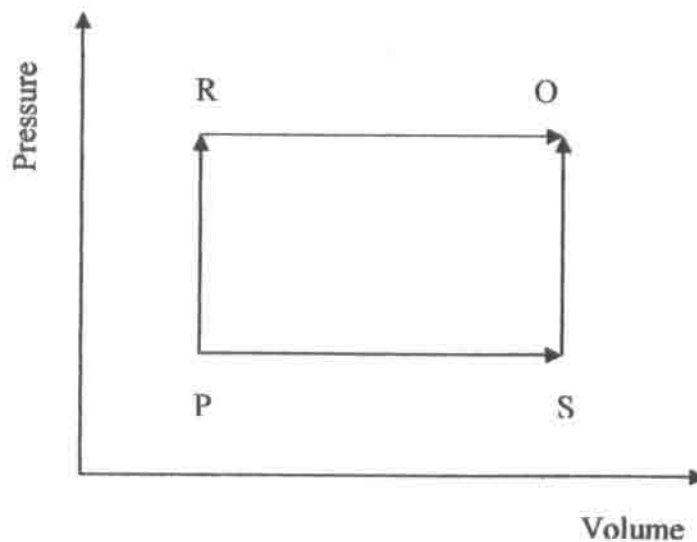
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Based on the graph above, which of the following deductions is not true ?

- A The shaded area below the straight line OW is of the same value as the strain energy
- B The Young Modulus for the wire is equal to the slope of the straight line OW
- C Permanent deformation ϵ_0 is produced when the stress is removed at stage X
- D The atomic plane in the wire slide between one another when the wire is stretched from X to Y



20. The diagram above shows the pressure and volume of a fixed mass of gas. The gas is brought from state P to state Q through stages PR and RQ. In this process, 8 joules of heat is absorbed by the gas and 3 J of work is done by the gas. 1 joule of work will be

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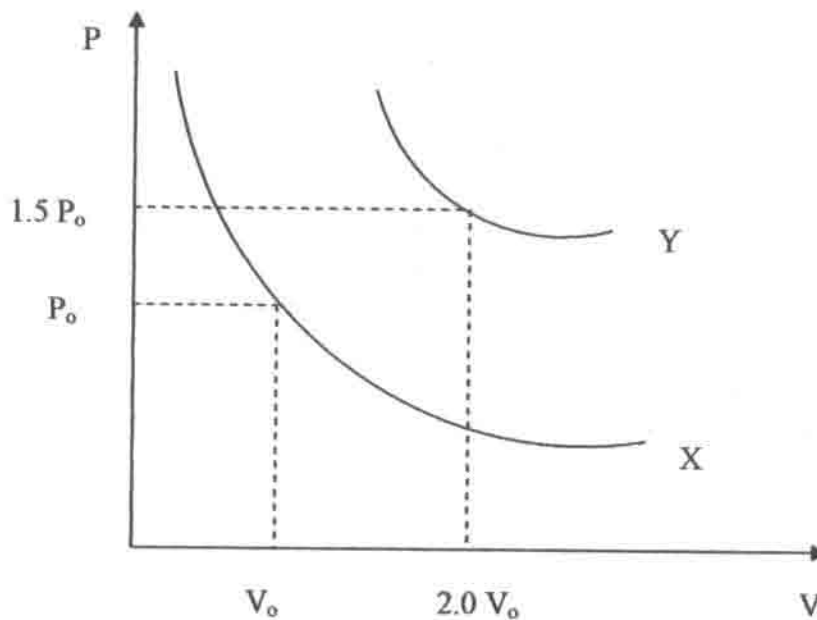
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done by the gas if the same resultant change occurs through stages PS and SQ. In this case,

- A 8 J of heat is absorbed
- B 4 J of heat is released
- C 12 J of heat is released
- D 6 J of heat is absorbed

21. The graph below shows the isothermal process for two ideal gases X and Y



If the mass and the thermodynamic temperature of gas X are m and T respectively and the mass of gas Y is $0.5m$, then the thermodynamic temperature of gas Y is

- A T
- B $1.5T$
- C $2.0T$
- D $6.0T$

22. The latent heat of sublimation per mole of a solid is L . Each mole is bonded to n neighbouring molecules. The energy required to break a bond is E . If N_A is the Avogadro's number, which of the following correctly relates E to L ?

- A $E = nL / (2 N_A)$
- B $E = nL / N_A$
- C $E = L / (n N_A)$
- D $E = 2L / (n N_A)$

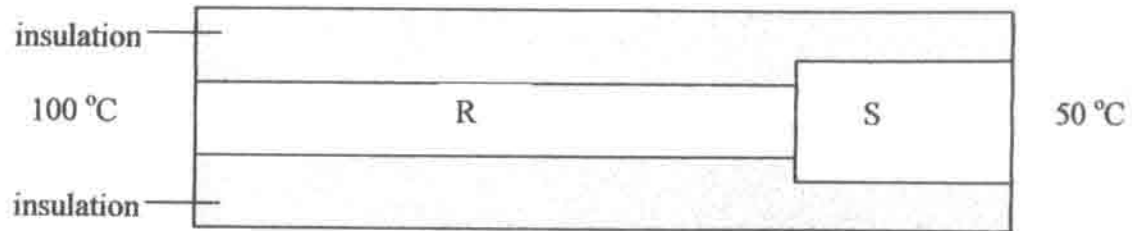
23. Two uniform copper rods R and S are joined and are well insulated as shown in the diagram below. The length of the rod R is twice that of rod S but the cross-sectional area of rod R is that half of rod S.

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If the free end of rod R and rod S are respectively fixed at 100 °C and 50 °C, what is the temperature at the joint of rod R and rod S?

- A 60 °C B 67 °C C 75 °C D 90 °C

24. An Adiabatic change in a gas is one

- A must be carried out fast in a container with very thin walls
 B where the temperature T and pressure P are related by the relationship $P^{-1} T = \text{constant}$
 C where the internal energy is constant
 D where no heat transfer takes place between the gas and the surroundings

25. The electric potential V is measured along a straight line PQ at different distances x from P. The results are shown in the table below

v/v	13	15	18	21	23
x/cm	0.020	0.030	0.040	0.050	0.060

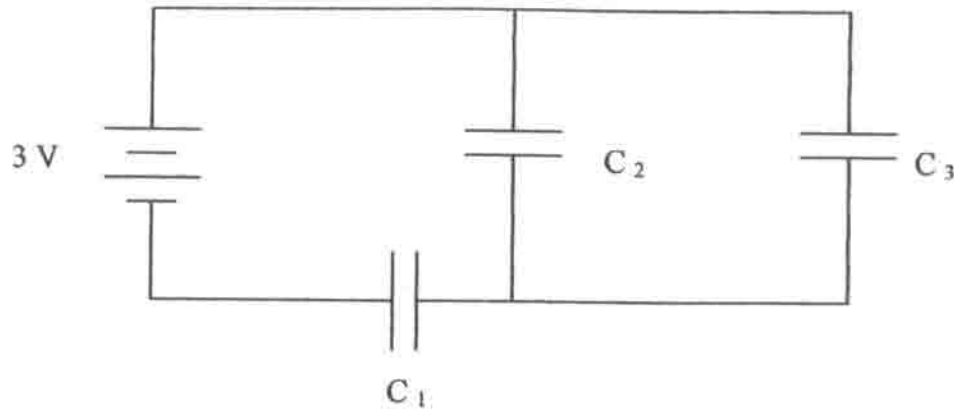
The component of the electric field along PQ when $x = 0.040$ is approximately

- A 300 V m^{-1} in the direction of Q
 B 75 V m^{-1} in the direction of P
 C 300 V m^{-1} in the direction of P
 D 430 V m^{-1} in the direction of Q

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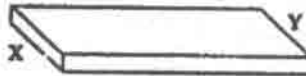
26. Three capacitors C_1 , C_2 and C_3 with capacitance $3 \mu\text{F}$, $2 \mu\text{F}$ and $4 \mu\text{F}$ respectively are connected as shown in the diagram to a 3 v supply



What is the charge on each of the capacitors

	Charge on C_1	Charge on C_2	Charge on C_3
A	$1 \mu\text{C}$	$2 \mu\text{C}$	$2 \mu\text{C}$
B	$6 \mu\text{C}$	$2 \mu\text{C}$	$4 \mu\text{C}$
C	$9 \mu\text{C}$	$18 \mu\text{C}$	$12 \mu\text{C}$
D	$12 \mu\text{C}$	$8 \mu\text{C}$	$4 \mu\text{C}$

27. A sheet of metal with a rectangular cross-section is shown in the figure below. The resistance between the side X and the side Y is R .



A material having resistivity half of that of the metal sheet is deposited uniformly on the top surface of the metal sheet. The thickness of the material is one-tenth that of the metal sheet. What is the new resistance between the side X and the side Y?

- | | | | |
|----|-------------------|----|-----------------|
| A. | $\frac{2}{3} R$ | B. | $\frac{5}{6} R$ |
| C. | $\frac{20}{21} R$ | D. | R |

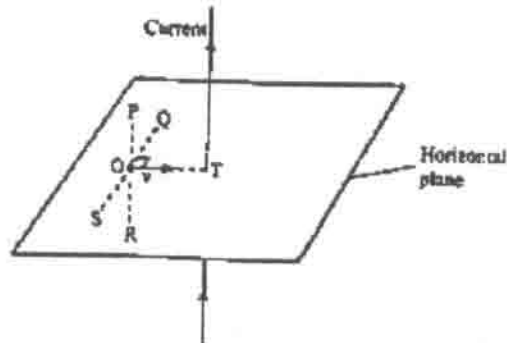
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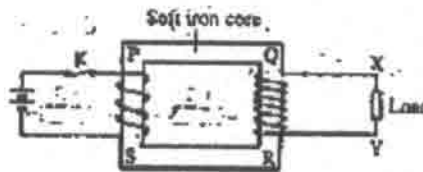
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28. The figure below shows a β -particle moving with velocity v adjacent to a wire carrying a large current and perpendicular to the horizontal plane.



The direction of the force on the β -particle is

- A. OP B. OQ C. OR D. OS
29. In the figure below, the switch K is closed and a steady current flows in the primary coil.



Which of the summaries below is correct regarding the magnitude and direction of the magnetic flux in the core and the direction of the induced current in the secondary coil when the switch K is opened?

- | | Magnitude of magnetic flux | Direction of magnetic flux | Direction of induced current |
|----|----------------------------|----------------------------|------------------------------|
| A. | Increases | Direction PQRS | X to Y |
| B. | Increases | Direction SRQP | Y to X |
| C. | Decreases | Direction PQRS | X to Y |
| D. | Decreases | Direction SRQP | X to Y |
30. Which of the following is true about the difference between a mechanical wave and an electromagnetic wave?
- | | Mechanical wave | Electromagnetic wave |
|----|---|---|
| A. | Propagates in vacuum | Cannot propagate in vacuum |
| B. | Of high frequency only | Of low frequency only |
| C. | Longitudinal or transverse wave | Longitudinal waves only |
| D. | Propagates with a speed less than that of light | Propagates with a speed almost the same or the same as speed of light |

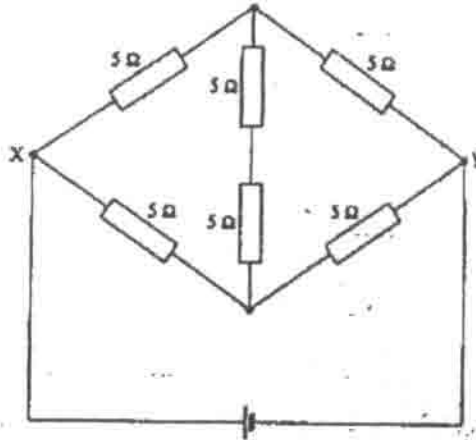
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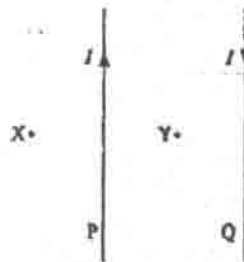
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31. The figure below shows an arrangement of six resistors of resistance $5\ \Omega$ each in a circuit.



The equivalent resistance between X and Y is

- A. $3.3\ \Omega$ B. $5.0\ \Omega$ C. $6.7\ \Omega$ D. $30.0\ \Omega$
32. The diagram below shows two long and parallel wires P and Q which carry current I in opposing direction. Point Y is situated in the middle between wire P and wire Q. Points X and Y are at the same perpendicular distance from wire P.



The ratio of the flux density at point Y to that at point X is

- A. 1 : 2 B. 2 : 1 C. 1 : 3 D. 3 : 1
33. What is the energy stored in a solenoid having an inductance $4.0\ \text{H}$ when a steady current of $1.5\ \text{A}$ flows through it?
- A. $3.0\ \text{J}$ B. $4.5\ \text{J}$ C. $9.0\ \text{J}$ D. $12.0\ \text{J}$

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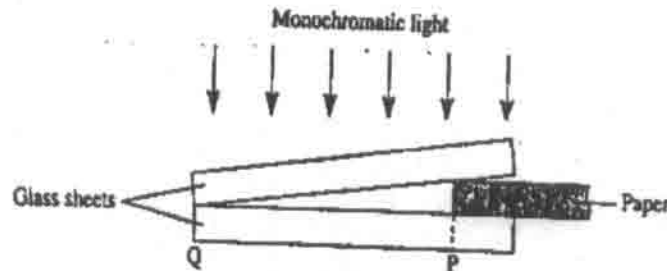
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34. What is the focal length of a spherical drop of water with a diameter of 4 mm?
[Refractive index of water = $\frac{4}{3}$]
- A. 2 mm B. 3 mm C. 4 mm D. 5 mm
35. When an air wedge is illuminated by a monochromatic light as shown in the figure below, a reflection interference pattern is produced.



The distance PQ is then reduced by pushing the paper a little into the air wedge. Which of the following is true regarding the changes that take place to the number of interference fringes and the separation of interference fringes between P and Q?

Number of interference fringes Separation of interference fringes

- A. Unchanged Increases
B. Unchanged Decreases
C. Decreases Increases
D. Decreases Decreases
36. A milliammeter with a resistance of 10Ω gives a full-scale deflection for a current of 15 mA. A shunt with a resistance of 0.015Ω is needed to be connected across the terminals of the milliammeter to change it into an ammeter. Wires P, Q, R and S below are provided to make the shunt.

Wire	Maximum current Which is safe/A
P	15
Q	13
R	6
S	5

Which of the wires from the table above are suitable to make the shunt?

- A. Wire P only C. Wire P and Q only.
B. Wire S only D. Wires P, Q, R and S.

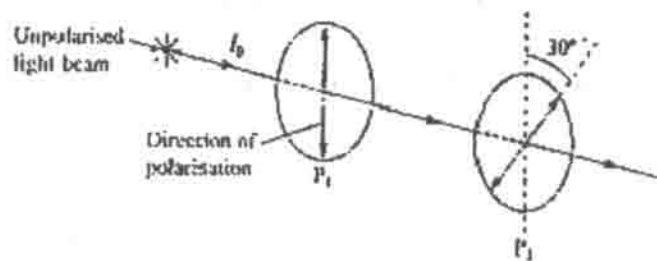
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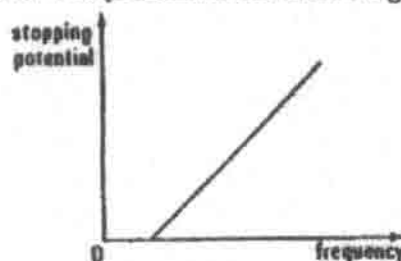
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37. Which of the following statements is true regarding Hall effect?
- The electric force by Hall voltage on the charge carrier is large than the magnetic force.
 - Hall voltage for metal is usually in the region of a few volts.
 - Hall voltage does not depend on the dimension of the substance under test.
 - Hall effect can be used to determine the type of charge carrier.
38. The diagram below shows a beam of unpolarised light of intensity I_0 which passes through polarisers P_1 and P_2 .



The intensity of the light after passing through P_2 is.

- $\frac{1}{8} I_0$
 - $\frac{1}{4} I_0$
 - $\frac{3}{8} I_0$
 - $\frac{3}{4} I_0$
39. In a photoelectric experiment, the potential difference required to stop the electrons is measured for various frequencies as shown in the graph below.



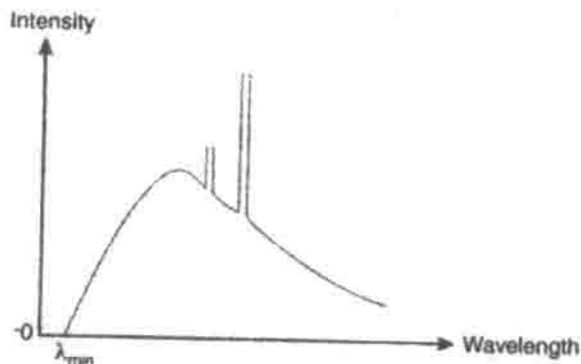
The gradient of the graph depends on the

- intensity of the incident radiation.
 - wavelength of the incident radiation.
 - work function of the irradiated surface.
 - Ratio of the Planck constant to the electronic charge.
40. A source emits monochromatic light of wavelength λ at power P . Given that h is the Planck constant and c the speed of light, the rate of emission of photons is
- $P \lambda / hc$
 - $Pc/h \lambda$
 - $\lambda c/Ph$
 - $hc/P \lambda$

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41. A beam of light of wavelength λ is totally reflected at normal incidence by a plane mirror. The intensity of the light is such that photons hit the mirror at a rate n . Given that the Planck constant is h , the force exerted on the mirror by this beam is
 A. $nh\lambda$ B. nh/λ C. $2nh/\lambda$ D. $2nh\lambda$
42. The energies of four levels of the hydrogen atom are level P, -13.60eV ; level Q, -3.40eV ; level R, -1.50eV ; level S, -0.85eV . Taking the Planck constant as $6.63 \times 10^{-34}\text{Js}$, the electron charge as $-1.60 \times 10^{-19}\text{C}$ and the speed of light as $3.00 \times 10^8\text{m/s}$, a spectral line of 488nm could result from an electron transition between levels
 A. Q and P B. S and Q C. S and P D. R and P
43. When a parallel beam of white light passes through a metal vapour, dark lines appear in the spectrum of the emergent light. This is principally because energy is absorbed and
 A. is not re-radiated at all.
 B. Is re-radiated as infra-red.
 C. Is re-radiated gradually over a long period of time.
 D. Is re-radiated uniformly in all directions.
44. The figure shows the variation of intensity with wavelengths for X-rays from an X-ray tube.



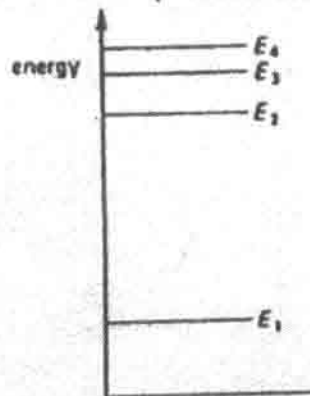
If the potential difference across the X-ray tube is increased, what happens to the value of λ_{\min} and the intensity of the continuous background spectrum ?

- | | λ_{\min} | Intensity of continuous background spectrum |
|----|------------------|---|
| A. | Decrease | increase |
| B. | Decrease | remains unchanged |
| C. | Increase | increase |
| D. | Increase | remains unchanged |

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45. Which of the following is not true about laser ?
- unpolarised
 - electromagnetic wave
 - high intensity
 - coherent
46. The mass of a nucleus ${}_{10}^{20}\text{Ne}$ is 19.99240u. The rest mass of a neutron and a proton is 1.008665u and 1.007825u respectively. The binding energy per nucleon for this nucleus is
- $2.577 \times 10^{-11} \text{ J}$
 - $1.288 \times 10^{-12} \text{ J}$
 - $1.189 \times 10^{-12} \text{ J}$
 - $1.077 \times 10^{-13} \text{ J}$
47. The diagram below represents the energy levels for an electron in a certain atom.



The transition from E_3 to E_1 produces a green line. What transition could give rise to a red line ?

- E_4 to E_3
 - E_4 to E_2
 - E_4 to E_1
 - E_2 to E_1
48. Which of the following is true about the number of neutrons and electric charge of the ${}_{82}^{208}\text{Pb}$ nucleus ?
- | | Number of neutrons | Electric charge |
|----|--------------------|----------------------------------|
| A. | 82 | $1.31 \times 10^{-17} \text{ C}$ |
| B. | 82 | $2.02 \times 10^{-17} \text{ C}$ |
| C. | 126 | $1.31 \times 10^{-17} \text{ C}$ |
| D. | 126 | $2.02 \times 10^{-17} \text{ C}$ |

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49. A stationary nucleus of radium-226 decays to radon-222 and an α -particle. If the kinetic energy of the α -particle is E, the total kinetic energy produced is
- A. E
 - B. Zero
 - C. Slightly more than E
 - D. Slightly less than E
50. The rate of radioactive decay dN/dt for N number of radioactive nuclei is $\frac{dN}{dt} = -\lambda N$. A higher decay constant means that the
- A. activity is lower
 - B. decay energy is lower
 - C. half-life is shorter
 - D. probability of decay per second is lower