

**CAMEROON COLLEGE OF ARTS, SCIENCE AND TECHNOLOGY (CCAST)
BAMBILI**

**LOWER SIXTH PROMOTION EXAMINATION
PHYSICS PAPER ONE**

One and a half hours

For each question there are five suggested answers: A, B, C, D, and E. When you have selected your answer to a question, write the letter for the answer you have chosen in the box provided on the answer sheet for that question. For example, if you think the answer to question 1 is E you write:

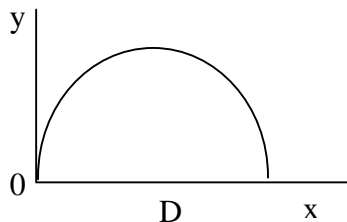
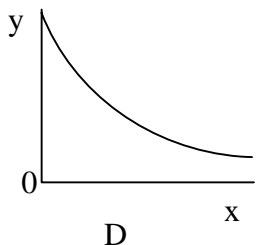
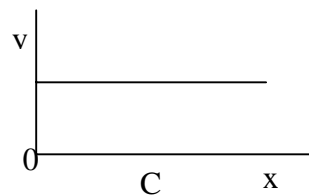
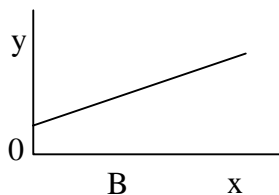
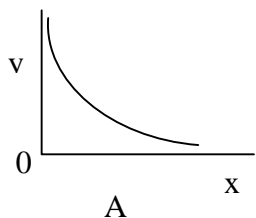
1	E
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QUESTIONS: 1-8

Directions: Each group of questions below consists of five lettered headings followed by a list of numbered questions. For each numbered question, select the one heading which is most clearly related to it. Each heading may be used once, more than once or not at all.

Question 1-4.

The graphs below show how one quantity, y, may vary with another quantity, x.



Which of the above graphs best illustrates the relationship between

	y	x
1	Drift velocity of electrons in a current carrying conductor.	Cross –sectional area of the conductor.
2	Velocity of a uniformly accelerated body	Time
3	Intensity of sound waves	Distance from the source.
4	Thermoelectric e.m.f	Temperature difference between the hot and the cold junctions of a copper –Bismuth thermocouple.

QUESTIONS: 5 –8

Choose from the list A to E below, the physical units suitable to measure the physical quantities given.

- A newton second
 - B newton
 - C newton metre
 - D newton per square metre
 - E watts
5. product of height of liquid column, liquid density, and acceleration due to gravity.
6. product of pressure and area
7. product of displacement separating forces of a couple and one of the forces.
8. product of pressure of a gas and change in volume.

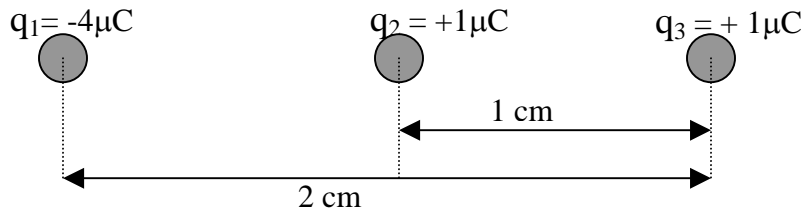
QUESTIONS 9 –26

Each of the questions or incomplete statements in this section is followed by five suggested answers.

Select the best answer in each case.

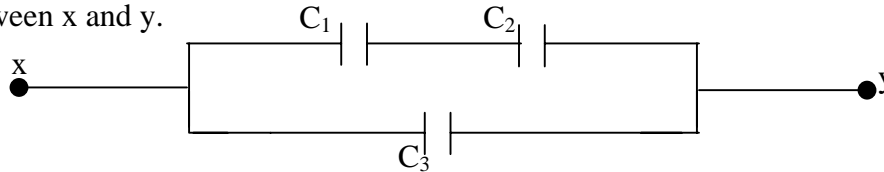
9. The condition for two bodies to be in thermal equilibrium is that
- A The bodies must not necessarily be at the same temperature but there should be exchange of thermal energy between them.
 - B The bodies must not necessarily be at the same temperature but must be in thermal contact.
 - C The bodies are at the same temperature and there is no net transfer of thermal energy between them.
 - D There should be a decrease in the internal energy of one body and an increase in the internal energy of the other.
 - E The bodies must have the same number of molecules.
10. Which of the following statements is **NOT** correct?
- A It is possible for a body to be at rest and yet have an acceleration
 - B It is possible for the velocity of a body to change without a change of speed.
 - C It is possible for the speed of a body to change without the body accelerating.
 - D An object can be accelerating in a direction opposite to that of its velocity.
 - E It is possible for a body to be accelerating while traveling at constant speed.

11. Three charges are located as shown.



- Taking $k = 9.0 \times 10^9 \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$, the force on the charge q_3 in N is
A 2.5 **B** 90 **C** 0 **D** -90 **E** 180
12. Two perfectly elastic identical spheres traveling in opposite directions with the same mass and speed of 0.01 kg and 30 m s^{-1} respectively collide head-on on a smooth horizontal surface. Which of the following statements about their motion is true?
A The sum of their momenta after collision is 0.60 kg ms^{-1}
B The sum of their momenta after collision is 0.060 kg ms^{-1}
C The sum of their kinetic energy after impact is zero
D The sum of their kinetic energy after impact is 9.0 joules
E The two bodies coalesce on impact giving a resultant speed of zero.

13. The sketch below shows three capacitors of capacitances C_1 , C_2 , and C_3 connected between x and y.



- What would be the effective capacitance of the combination between x and y?
A $(C_1 + C_2 + C_3)/(C_2 + C_3)$ **B** $C_1 + C_2 + C_3$
C $C_1 C_2 C_3 / (C_1 + C_2 + C_3)$
D $(C_1 C_2 + C_2 C_3 + C_1 C_3) / (C_1 + C_3)$ **E** $C_2 C_3 / (C_1 C_2 + C_2 C_3 + C_1 C_3)$
14. Which of the following three physical quantities x, y and z are all scalar?

	x	y	z
A	Weight	displacement	Speed
B	force	Displacement	Velocity
C	Temperature	Mass	Velocity
D	Work	Energy	Momentum
E	Mass	temperature	Work

15. A block of metal x of mass m at 0°C comes into contact with another metal y of mass $4m$ at 100°C . Thermal equilibrium at a temperature of 20°C is

established between the blocks with no loss of energy to the environment. If the heat capacity of x and y are c_y and c_x respectively, then

A	$c_x = c_y$
B	$4c_x = c_y$
C	$c_x = 8c_y$
D	$c_x = 16c_y$
E	$c_x = 2c_y$

16. When monochromatic light passes from air into glass, there is no change in its
 A amplitude B frequency C intensity D speed
 E wavelength
17. Which of the following properties of a gas thermometer could **NOT** be regarded as a reason for its adoption as a standard?
 A A wide range of temperatures can be covered
 B Expansion of the containing envelope is relatively small
 C It is capable of high accuracy
 D Thermometers using different gases give good agreement if the pressures are low
 E Use of a pressure gauge as an indicator makes it direct reading.
18. A uniform wire is fixed at both ends and under tension T is in resonance with a tuning fork when the wire is vibrating transversely in its fundamental mode. The tension is now decreased in small successive steps until a second resonance is encountered. The tension is now
 A $(1/2)T$ B $(4/9)T$ C $(1/3)T$ D $(1/4)T$
 E $(1/9)T$
19. When a $4\ \Omega$ resistor is connected between the terminals of a certain cell a 2 A current flows. When the $4\ \Omega$ resistor is replaced by one of $2\ \Omega$ the current is 3 A, the e.m.f and internal resistance of the cell are respectively
 A 15 V, $4\ \Omega$ B 12 V, $2\ \Omega$ C 10 V, $1\ \Omega$ D 8 V, zero
 E 6 V, zero.
20. The distance between the centers of molecules in water is 4.0 nm. If the water freezes the distance could be expected to be
 A 3.5×10^{-7} m B 3.0×10^{-7} m C 4.0×10^{-8} m
 D 4.5×10^{-9} m E 3.5×10^{-9} m.

21. A piece of lead of mass 0.05 kg falls through glycerine at its terminal velocity. The acceleration of free fall is 9.8 m s^{-2} . The resistive force exerted on the mass by the liquid is
 A 0.05 N B 0.49 N C 0.50 N D 4.90 N
 E 10.00 N.

22. Under which set of conditions will bright fringes of a double –slit interference pattern be furthest apart?

	Distance between slits	Distance from slits to screen	Wavelength of source
A	small	large	long
B	small	large	short
C	small	small	short
D	large	small	long
E	large	small	short

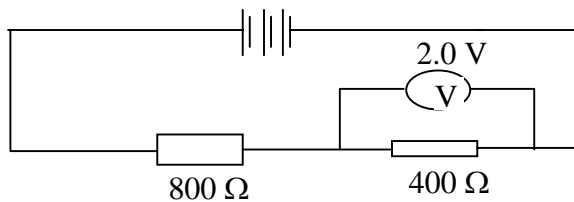
23. A ray of light in crown glass of refractive index $3/2$ is incident on a boundary with water of refractive index $4/3$. The critical angle c is given by

- A $\sin c = 2/3$ B $\sin c = 3/4$ C $\sin c = 8/9$
 D $\sin c = \frac{3/2}{4/3}$ E $\sin c = 3/2 \times 4/3$

24. Which of the following quantities is always conserved in an interaction between two masses in an isolated system?

- A velocity B acceleration C linear momentum
 D kinetic energy E potential energy.

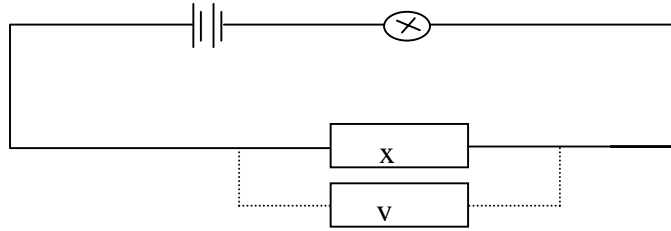
25. The figure below shows connections of a battery, resistors and voltmeter in a circuit.



The value of current in amperes through the 800Ω resistor is

A	B	C	D	E
8×10^{-3}	1×10^{-2}	2.5×10^{-2}	1.25×10^{-2}	5×10^{-3}

26.



Which of the following statements is **NOT** true about the connections in the above circuit?

- A The bulb lights irrespective of the current direction through box x
- B The bulb does not light no matter the polarity of y in the circuit.
- C If x and y are connected in series, the bulb does not light.
- D If x and y are connected in parallel, the bulb will light.
- E Bulb does not light for either x or y in the circuit.

Questions 27 –39 (Thirteen questions).

Directions. For each group of questions below ONE or MORE of the responses given is/are correct. Decide which of them is/are correct and then choose

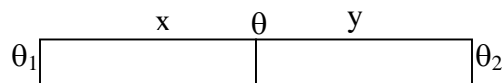
Directions Summarised				
A	B	C	D	E
1, 2, 3 correct	1, 2 correct	2, 3 correct	1 only	3 only

- 27. The resistivity of a material in a cylindrical sample
 - 1 depends on the length of the cylinder
 - 2 depends on the cross-sectional area
 - 3 is independent of length and cross-sectional area of the cylinder.

- 28. When ice at 0 °C melts to form water at the same temperature
 - 1 it absorbs latent heat of fusion
 - 2 work is done on the system
 - 3 the internal energy of the system increases.

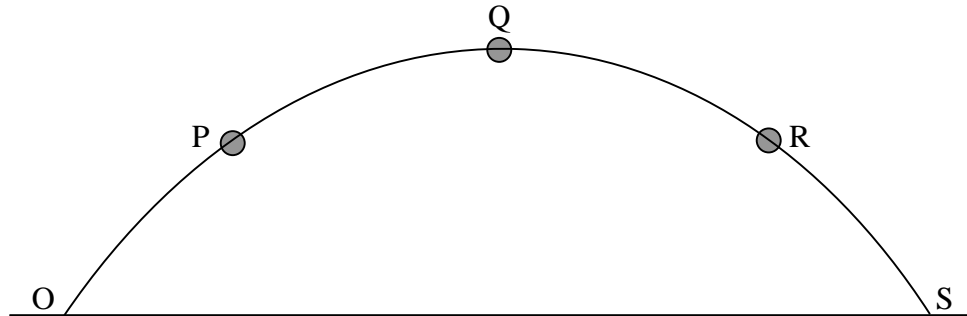
- 29. In which of the following cases is the speed proportional to \sqrt{T} where T is the absolute temperature of the system.
 - 1 The speed of electromagnetic wave in air
 - 2 The speed of sound wave in a gas
 - 3 The r.m.s speed of molecule in a particular gas.

- 30. A composite material made of x and y has x and y in contact with hot water at temperature, θ_1 and cold water at temperature, θ_2 .



If k_x and k_y are the thermal conductivities of x and y respectively where $k_x > k_y$, then at steady state,

- 1 $\theta_1 - \theta$ is greater than $\theta - \theta_2$
 - 2 the temperature gradient across x is less than that across y
 - 3 in order to have a uniform material of the same thermal resistance, material y can be replaced by material x of longer length
31. A body travels with constant speed along a circular path, which of the following quantities associated with its motion remain(s) constant?
- 1 Kinetic energy
 - 2 Angular velocity
 - 3 Linear momentum
32. Which of the following resultant forces could be produced by combining a force of 3 N with a force of 4 N?
- 1 1 N
 - 2 7 N
 - 3 5 N
33. A goal keeper kicks a football from his goal post O and it follows the parabolic path shown below to land around the centre of the field at a point S.

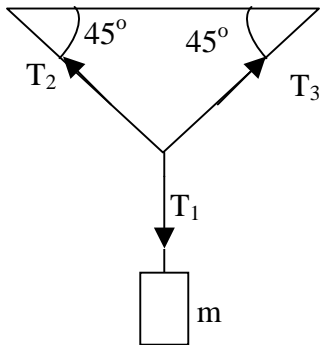


- If Q is the centre of the path and points P and R are of same height above the ground, then
- 1 the time for the ball to rise up to Q is less than time for ball to fall from R to S.
 - 2 velocity of ball at P is the same as the velocity of ball at R
 - 3 speed of the ball at p is same as the speed of ball at R.
34. A fish at the bottom of a pond appears to be nearer to an observer than it actually is because the
- 1 the light passing from water to air changes its speed
 - 2 water magnifies it
 - 3 water reflects the light.

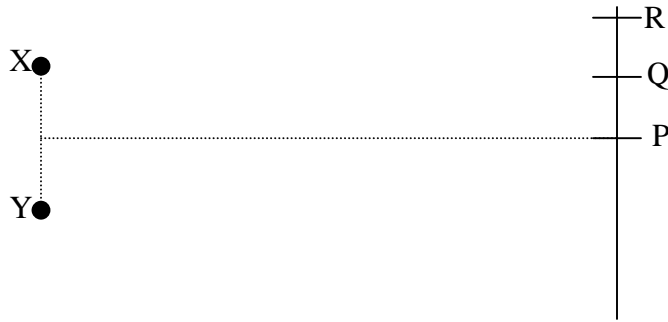
35. If a metallic conductor, area of cross – section A has n ‘free’ electrons per unit volume each of which carries a charge e and move with drift velocity v
- 1 the current density is nev
 - 2 the electron drift velocity decreases with temperature
 - 3 the current flow is evA.
36. If the emf of a cell is E then
- 1 The potential difference between its terminals when no current flows through the cell is equal to E
 - 2 When a charge Q is drawn from the cell, the energy transferred is equal to EQ
 - 3 When the cell supplies a current I the total power dissipated is less than EI due to the internal resistance of the cell.
37. An electric charge is given to an insulated metal plate that is parallel and close to a similar earthed plate. The separation of the plates is now increased (using a non-conducting handle).
- 1 work must be done to separate the plates
 - 2 the electric field strength between the plates decreases
 - 3 charges flow onto the earthed plate.
38. The diagram below shows an object of mass m suspended by a string that is joined to two other strings. Which of the following statements about the tensions T_1 , T_2 , and T_3 acting on the string is /are? true?

A	$T_1 = mg$
B	$T_2 = T_3$
C	$T_3 = mg/2 \cos 45^\circ$

38.



39. Two waves of same wavelength, λ , phase difference and amplitude are emitted from x and y, in figure below. At P there is a maximum; at Q is a minimum and at R a maximum disturbance. Such an observation may be obtained if
- 1 $XP = YP$
 - 2 $YQ - XQ = \lambda$
 - 3 $YR - XR = \lambda/2$

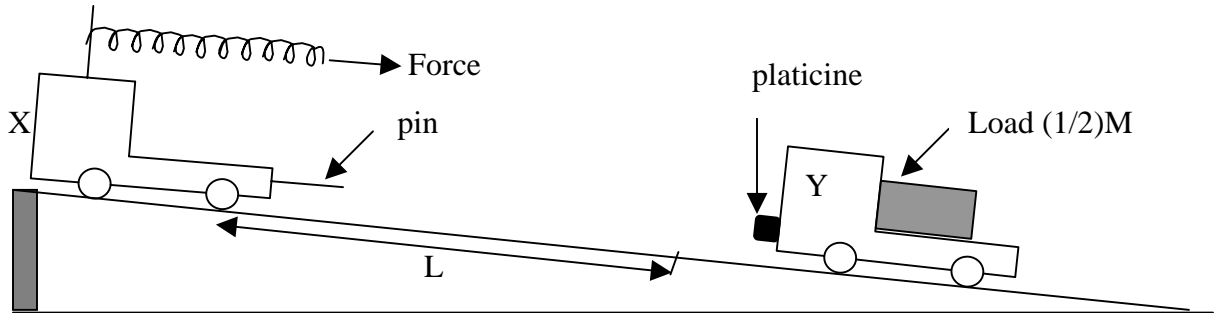


Questions 40 – 45

Directions: The questions in this section are grouped together. Each question in a group relates to a common theme. Select the best answer for each question.

Questions 40 – 42

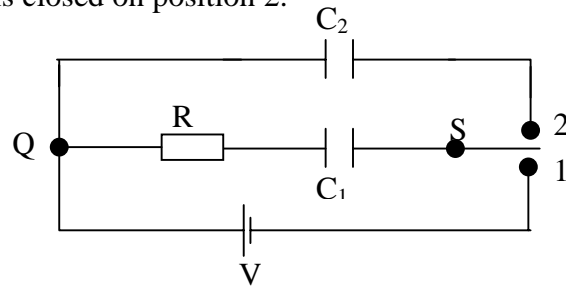
A trolley X of mass M is pulled down a friction –compensated slope by a helical spring attached to the trolley as shown. The spring is kept extended by 10 cm and the trolley reaches a speed v in moving a distance L from rest.



40. The time for the trolley to move the distance L from rest is
 A $L/2v$ B L/v C $2L/v$ D $v^2/2L$
 E $2v^2/L$
41. If the spring had been extended 15 cm instead of 10 cm the speed reached after moving a distance L from rest would have been
 A $2v/3$ B $v\sqrt{(2/3)}$ C $v\sqrt{(3/2)}$ D $3v/2$
 E $9v/4$
42. After being pulled for a distance L as in question 41, the spring becomes detached and the trolley X strikes a stationary trolley y also of mass M and carrying a load of mass $1/2M$. The pin on X sticks into the plasticine on Y and both trolleys then move together down the slope. After the collision the speed of the linked trolleys is
 A $2v/5$ B $2v/3$ C $4v/25$
 D $v(2/5)^{1/2}$ E $v(2/3)^{1/2}$

Questions 43-45

In the circuit shown in the figure below, the capacitors with capacitance C_1 and C_2 ($C_1 = 2C_2$) are initially uncharged. Switch S, is first closed on position 1 until C_1 is charged fully. After which it is closed on position 2.



43. A Immediately switch S is closed on point 1, the current through R is determined partly by the capacitance C_1
- B Immediately S is closed on point 1 the current through R is determined by both C_1 and C_2 .
- C C_1 is fully charged after a time $T = CR$.
- D Immediately switch S is closed on point 1 the current through R is a maximum.
- E The current through the resistor at any time does depend upon whether it is placed immediately before C_1 or after C_1 on the branch QS.
44. After C_1 is fully charged, switch S is closed on point 2.
- A Current flows through R until C_1 is completely discharged.
- B Current flows through R until the charge stored in C_2 is equal to the charge stored on C_1 .
- C Current flows through R until the potential across C_2 equal the potential across C_1 .
- D Current flows through R until the potential across C_2 equal to the potential across R.
- E Current flows through R until charge stored on C_2 is equal twice the charged stored on C_1 .
45. With the switch still connected to 2 and no current through R,
- A The energy stored on C_1 is equal to the energy stored on C_2 .
- B The energy stored on C_1 is equal to twice the energy stored on C_2 .
- C The energy stored on C_1 is equal to four times the energy stored on C_2 .
- D The energy stored on C_1 is equal to one half the energy stored on C_2 .
- E The energy stored on C_1 is equal to one quarter the energy stored on C_2 .