

SULIT

960/1

SEPTEMBER 2009

**PEPERIKSAAN PERCUBAAN
SIJIL TINGGI PELAJARAN MALAYSIA
NEGERI PAHANG DARUL MAKMUR**

PHYSICS

PAPER 1

One hour and forty-five minutes

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.

PHYSICS

PAPER 1 (1 ¾ HOURS)

SEKOLAH MENENGAH KEBANGSAAN SULAIMAN
28700 BENTONG PAHANG

TRIAL EXAMINATION 2009

UPPER SIX SCIENCE

NOTE

In addition to this paper you will require the following items

1. Calculator
2. Data Booklet

List of fundamental physical constants found in the Data Booklet

Speed of light in free space	$c = 3.00 \times 10^8 \text{ ms}^{-1}$
Permeability of free space	$\mu_0 = 4 \pi \times 10^{-7} \text{ H m}^{-1}$
Permittivity of free space	$\epsilon_0 = 8.85 \times 10^{-12} \text{ F m}^{-1} = [1/(36 \pi)] \times 10^{-9} \text{ F m}^{-1}$
Magnitude of electronic charge	$e = 1.60 \times 10^{-19} \text{ C}$
Planck constant	$h = 6.63 \times 10^{-34} \text{ Js}$
Unified atomic mass constant	$u = 1.66 \times 10^{-27} \text{ kg}$
Rest mass of electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
Rest mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
Molar gas constant	$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
Avogadro constant	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
Boltzmann constant	$K = 1.38 \times 10^{-23} \text{ J K}^{-1}$
Acceleration of free fall	$G = 9.81 \text{ m s}^{-2}$
Gravitational constant	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$

- 1 Variation of the velocity v in m s^{-1} of an automobile with time t in second is given by

$$v = at^2 + bt^3$$

The units of a and b respectively are

- A m s^2 and m s^4
 B $\text{m}^{-1} \text{s}^3$ and $\text{m}^{-1} \text{s}^4$
 C m s^{-2} and m s^{-3}
 D m s^{-3} and m s^{-4}

at² =
 $\text{m s}^{-1} = \text{m s}^{-1}$
 $a = \text{m s}^{-3}$

$\text{m s}^{-1} = b \text{s}^3$
 $b = \text{m s}^{-4}$

- 2 Suppose $A = B^n C^m$, where A has dimensions LT , B has dimensions $\text{L}^2 \text{T}^{-1}$, and C has dimensions LT^2 . Then the values of the indices n and m are respectively:

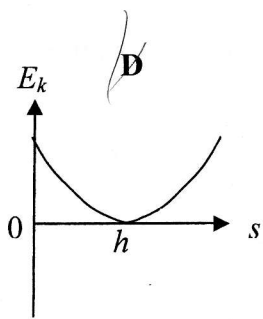
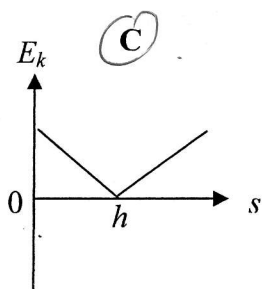
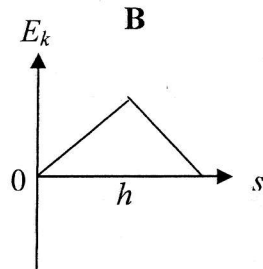
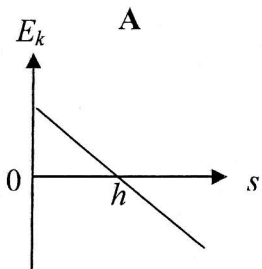
- A $\frac{2}{3}$ and $\frac{1}{3}$
 B 2 and 3
 C $\frac{4}{5}$ and $\frac{1}{5}$
 D $\frac{1}{5}$ and $\frac{3}{5}$

$\text{m s} = (\text{m}^2 \text{s}^{-1})^n (\text{m s}^2)^m$
 $\text{m s} = \text{m}^{2n} \text{s}^{-n} \text{m}^m \text{s}^{2m}$

$2(\frac{1}{5}) + m = 1$
 $5n = 1$
 $n = \frac{1}{5}$

$2m - n = 1$
 $2n + m = 1$
 $4n + 2m = 2$ (1)
 $2m - n = 1$ (2)

- 3 A stone is thrown vertically upwards from the ground level, rises to a height h and then falls back to its starting point. Assuming that air resistance is negligible, which of the following graphs best shows how E_k , the kinetic energy of the stone, varies with s , the distance travelled?



$KE = \frac{1}{2}mv^2$
 $KE = \frac{1}{2}m(\text{m s}^{-1})^2$
 $KE = \frac{1}{2} \frac{\text{m}^2}{\text{s}^2}$

- decrease linearly.

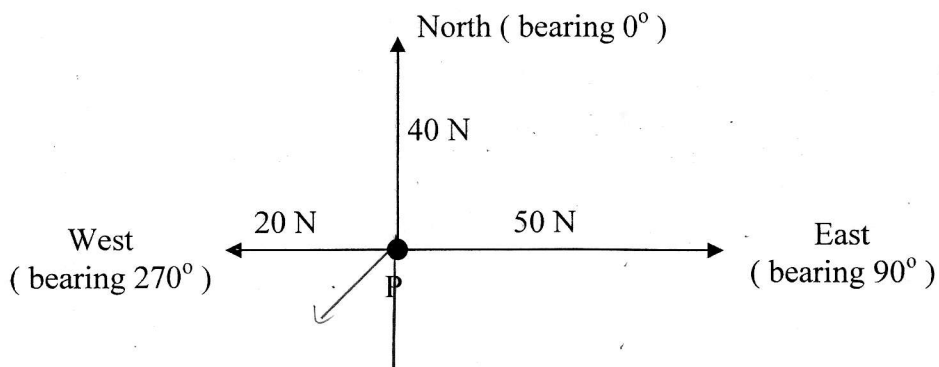
4 A base ball is thrown vertically into the air. The acceleration of the ball at its highest point is

- ☒ A 9.8 m s^{-2} downwards
- ☐ B 9.8 m s^{-2} upwards
- ☐ C Changing suddenly from 9.8 m s^{-2} upwards to 9.8 m s^{-2} downwards
- ☐ D Cannot be calculated without knowing the initial velocity

5 Which of the following pairs contains a vector and a scalar?

- ☐ A displacement \checkmark : acceleration \checkmark
- ☒ B angular momentum \checkmark : kinetic energy \checkmark
- ☐ C momentum \checkmark : torque \checkmark
- ☐ D power \checkmark : speed \checkmark

6 Three coplanar forces having magnitudes 20 N, 40 N dan 50 N, act upon a particle P as shown in the figure below.



Which of the following is the bearing of the additional that is required to keep the particle in equilibrium?

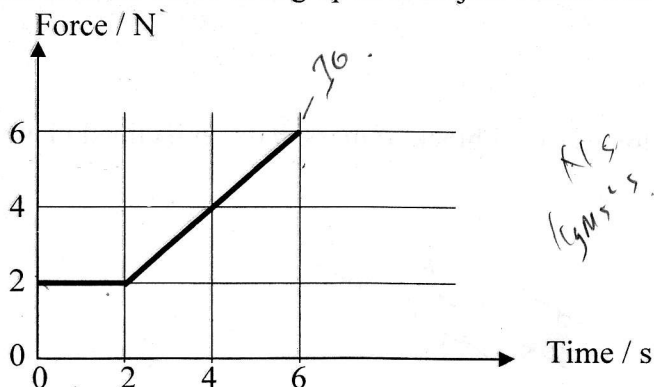
- A 37° ☒
- B 127° ☐
- C 143° ☐
- ☒ D 217°

40

40 + 50

40 60

- 7 The graph below shows how the force acting upon an object varies with time.



1 kg m s^{-1} mv
 kg m s^{-1}

Assuming the object moves in a straight line, what is its change of momentum?

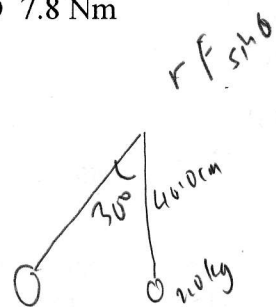
- A 40 kg m s^{-1} B 36 kg m s^{-1} C 20 kg m s^{-1} D 16 kg m s^{-1}

- 8 Two pendulum bobs of unequal mass are suspended from the same fixed point by strings of equal lengths. The lighter bob is drawn aside and then released so that it collides with the other bob on reaching the vertical position. The collision is elastic. What quantities are conserved in the collision?

- A Both kinetic energy and angular momentum of the system.
B Only kinetic energy.
C Only angular momentum.
D Angular speed of the lighter bob.

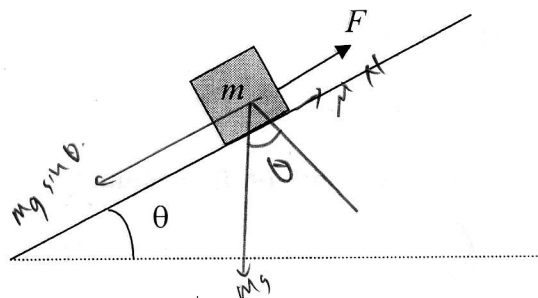
- 9 A simple pendulum of length 40.0 cm has a bob of mass 2.0 kg . The bob is pulled to one side until the pendulum makes an angle of 30° with the vertical. What is the torque acting on the bob when the bob is released?

- A 0.3 Nm B 3.9 Nm C 6.8 Nm D 7.8 Nm



(40.0×10)

- 10 The diagram below shows a block of mass m on an inclined plane at an angle θ to the horizontal.



If μ is the coefficient of friction between the block and the plane, the minimum value of F required to prevent the block from slipping down is

- A $mg \sin \theta$ B $\mu mg \cos \theta$ C $mg(\sin \theta - \mu \cos \theta)$ D $mg(\sin \theta + \mu \cos \theta)$

- 11 If the radius of curvature of a corner is r , the maximum speed of a car rounding the corner without sliding is directly proportional to

A $\frac{1}{r^2}$

B $\frac{1}{\sqrt{r}}$

C \sqrt{r}

D r^2

- 12 A particle of mass m is performing a simple harmonic motion with amplitude a . If the maximum kinetic energy of the particle is E , the frequency of the simple harmonic motion can be expressed as

A $\frac{1}{2\pi} \sqrt{\frac{2E}{ma}}$

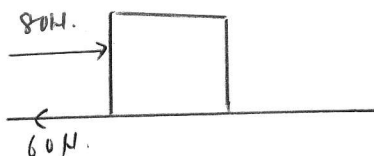
B $\frac{1}{2\pi} \sqrt{\frac{ma}{2E}}$

C $\frac{1}{2\pi} \sqrt{\frac{E}{ma^2}}$

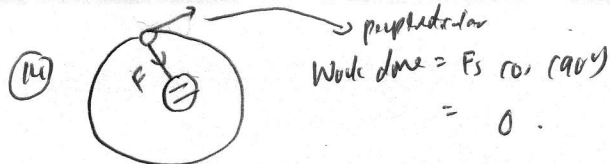
D $\frac{1}{2\pi} \sqrt{\frac{2E}{ma^2}}$

- 13 A block is pushed a distance 10 m along a plane horizontal surface by a force of magnitude 80 N. The frictional force opposing motion is 60 N. How much of the work done is converted to heat and how much is converted to kinetic energy of the block?

	Heat / J	Kinetic energy / J
A	200	600
B	200	800
C	600	200
D	600	800



Work done = $80 \times 10 = 800 \text{ J}$
 Heat energy = due to frictional force
 = $60 \times 10 = 600 \text{ J}$
 Kinetic energy = $800 \text{ J} - 600 \text{ J} = 200 \text{ J}$



14 A communication satellite of mass m moves with uniform angular velocity ω in a circular orbit of radius r from the centre of Earth.

What is the work done by the gravitational force on the satellite in one revolution?

- (A) Zero (B) $2\pi mr^2 \omega^2$ (C) $\pi mr^3 \omega^2$ (D) $mr^2 \omega^2$

15 A particle moves uniformly along a circular path.

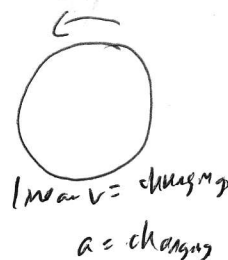
Which of the following correctly describe the linear velocity, angular velocity and linear acceleration of the particle?

linear velocity

Angular velocity

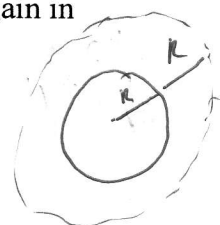
linear acceleration

- | | | |
|---------------------|-----------------|-----------------|
| (A) constant | constant | always changing |
| (B) always changing | constant | zero |
| (C) constant | always changing | constant |
| (D) always changing | constant | always changing |

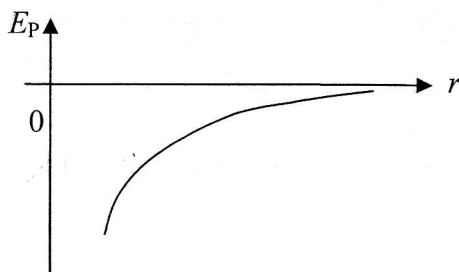


16 An object of mass m is raised from the earth's surface to a height R where R is the radius of the earth. If the mass of the earth is M and the gravitational constant is G , what is the gain in potential energy of the object?

- Handwritten: $G_{\text{avg}} = -\frac{Gm}{2R} - (-\frac{Gm}{R}) = \frac{Gm}{2R}$
- (A) $\frac{GmM}{\sqrt{2}R}$ (B) $\frac{GmM}{2R}$ (C) $\frac{GmM}{R}$ (D) $\frac{2GmM}{R}$

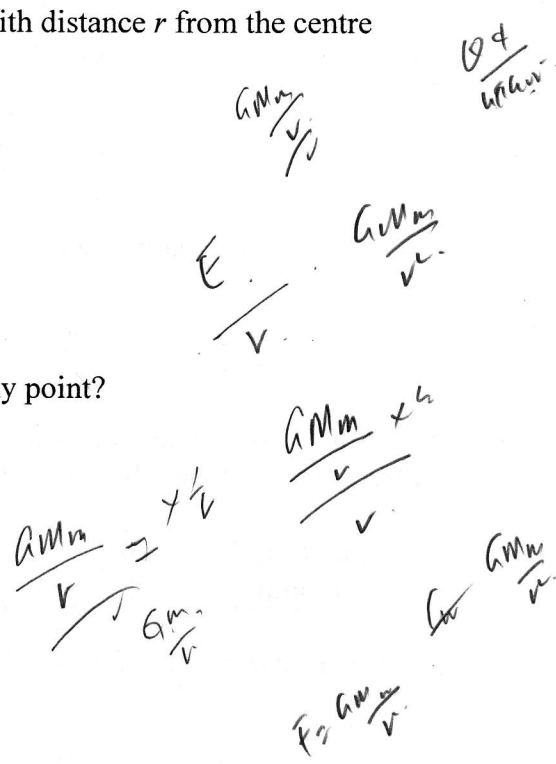


17 The gravitational potential energy E_p of an object varies with distance r from the centre of a planet as shown in the diagram below.

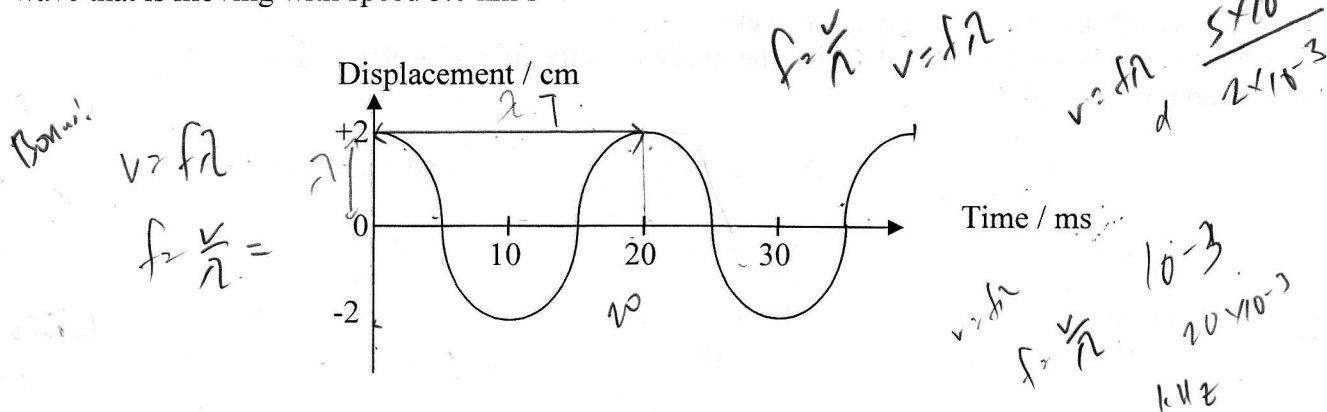


What quantity is represented by the gradient of the graph at any point?

- (A) Gravitational potential at the distance r .
 (B) Gravitational field strength at the distance r .
 (C) Force that pulls the object towards the planet.
 (D) Acceleration of the object towards the planet.



- 18 The figure below represents the simple harmonic motion of a particle in a progressive wave that is moving with speed 5.0 km s^{-1}



What is the frequency of vibration of the particle?

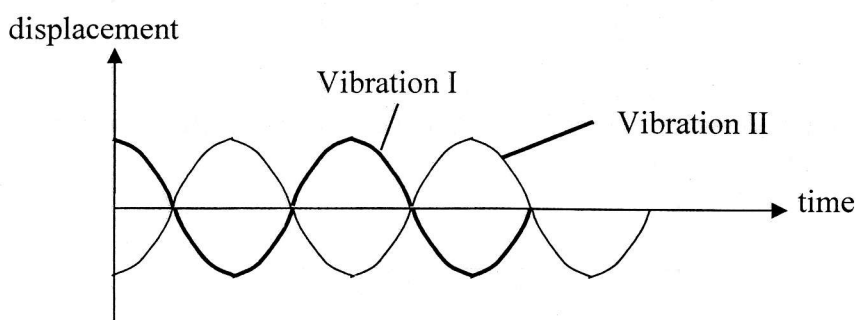
A 5.0 kHz

B 25 kHz

C 50 kHz

D 100 kHz

- 19 The diagram below shows two vibrations.



What is the phase difference between the two vibrations in radians?

A $\frac{\pi}{4}$

B $\frac{\pi}{2}$

C $\frac{3\pi}{4}$

D π

- 20 The values of acceleration a of a particle in simple harmonic motion as a function of displacement x is tabled below.

$a / \text{mm s}^{-2}$	16	8	0	-8	-16
x / mm	-4	-2	0	2	4

The period of this motion is

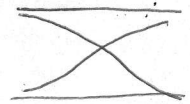
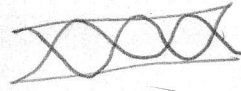
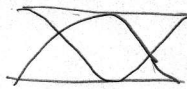
A $\frac{1}{\pi} \text{ s}$

B $\frac{2}{\pi} \text{ s}$

C $\frac{\pi}{2} \text{ s}$

D $\pi \text{ s}$

Handwritten notes: $a = -\omega^2 x$, $\omega^2 = \frac{16}{4} = 4$, $\omega = 2$, $\frac{2\pi}{T} = 2$, $T = \pi$



21 A resonance tube opened at both ends and having a vibrating tuning fork placed near one end

- ☒ A always has a node in the middle.
- ☒ B always has an antinode in the middle.
- ☐ C always has an odd total number of nodes
- ☐ D always has an odd number for total number of nodes and antinodes

open

$P_1 V_1 = P_2 V_2$

22 An ideal gas contained in a cylinder with piston is allowed to expand from volume V_1 and pressure P_1 to volume V_2 and pressure P_2 . Its temperature is kept constant all the time. The work done by the gas is

- ☐ A zero, because it obeys Boyle's law and so $P_2 V_2 - P_1 V_1 = 0$
- ☐ B negative, because the pressure has decreased and therefore the force on the piston is decreasing
- ☒ C zero, because the gas is kept at constant temperature and therefore internal energy is unchanged.
- ☒ D positive, because the volume has increased. (expansion)

$$P_1 V_1 = P_2 V_2$$

$P \propto \frac{1}{V}$

$$A = A_0 \cos \theta$$

$$I = I_0 \cos^2 \theta$$

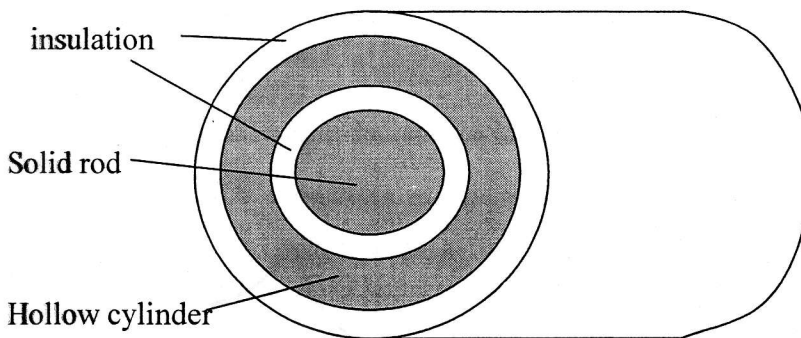
$$I \propto k A^2$$

$$I = I_0 A^2$$

23 A sound wave with amplitude 0.20 mm is of intensity 3.0 W m^{-2} . What is the intensity of another sound wave of the same frequency but has amplitude 0.40 mm?

- ☐ A 6.0 W m^{-2}
- ☐ B 9.0 W m^{-2}
- ☒ C 12 W m^{-2}
- ☐ D 15 W m^{-2}

24 The diagram below shows a solid rod and a hollow thick cylinder having the same axis and of the same length, each having cross sectional area A and $2A$ respectively. The space between the rod and cylinder and the outer layer are insulated perfectly. The ends of this arrangement are maintained at temperature θ_1 and θ_2 .



$$R \propto \frac{1}{A}$$

If the thermal conductivity of the rod and the cylinder are k and $3k$ respectively and the rate of heat flow along the rod is W , what is the rate of heat flow along the cylinder?

- ☒ A $6W$
- ☐ B $\frac{3}{2}W$
- ☒ C W
- ☐ D $\frac{1}{6}W$

$$R \propto \frac{1}{A}$$

$$\frac{d\theta}{dx} = -kA \frac{d\theta}{dx}$$

25 The average kinetic energy of the molecules of an ideal gas in a container of fixed volume has been increased by 4 times. What will happen to the pressure of the gas?

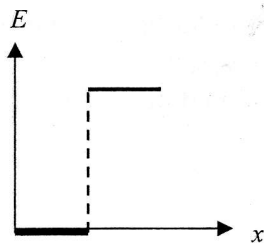
- A It increases by 2 times
- ~~B It increases by 4 times~~
- C It increases by 8 times
- D It increases by 16 times

26 Which of the following statements about electric potential is **false**?

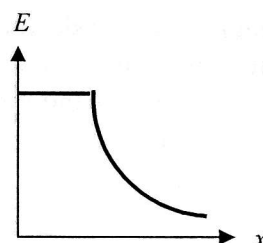
- A It is a scalar quantity.
- B Its unit is J C^{-1} .
- C It is defined as the energy required to transfer 1 C charge from infinity to a certain point.
- ~~D Its value decreases if a positive test charge is moved against the direction of an electric field.~~

27 An isolated hollow conducting sphere of radius r is charged positively. Which of the following is the graph of electric field intensity E against distance x from the centre of the sphere?

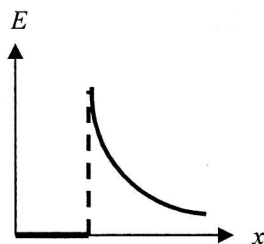
A



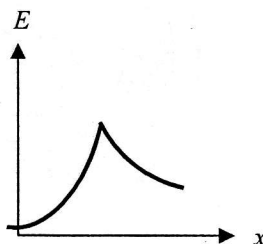
C



~~B~~



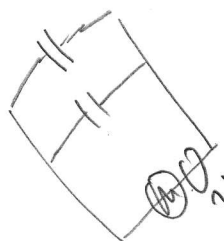
D



28 A $2 \mu\text{F}$ capacitor is charged to 200 V and then it is isolated. When an uncharged capacitor is connected in parallel with the first capacitor, the common potential difference becomes 40 V. The capacitance of the second capacitor is

- A $2 \mu\text{F}$
- B $4 \mu\text{F}$

- ~~C $6 \mu\text{F}$~~
- ~~D $8 \mu\text{F}$~~



$$\frac{1}{2 \times 10^{-6}} + \frac{1}{C} = \frac{1}{1 \times 10^{-4}}$$

$$\frac{1}{C} = \frac{1}{1 \times 10^{-4}} - \frac{1}{2 \times 10^{-6}}$$

$$\frac{1}{C} = \frac{1}{1 \times 10^{-4}} - \frac{50}{1 \times 10^{-4}}$$

$$\frac{1}{C} = \frac{1 - 50}{1 \times 10^{-4}}$$

$$\frac{1}{C} = \frac{-49}{1 \times 10^{-4}}$$

$$C = \frac{1 \times 10^{-4}}{-49}$$

$$C = -2.04 \times 10^{-6} \text{ F}$$

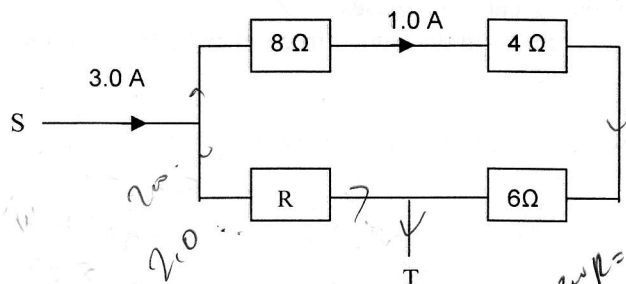
$$C = -2.04 \mu\text{F}$$

- 29 A wire with uniform cross-sectional area has a resistance of R . The wire is stretched so that its length is increased by 10%. Assuming that the wire becomes thinner uniformly, its new resistance is

A $0.83 R$
B $0.90 R$

~~C~~ R
~~D~~ $1.21 R$ because become thinner!

- 30 A direct current of 3.0 A flows from S to T in a circuit as shown in the figure below.



$R = (8 + 4 + 6) \Omega$

What is the resistance of R ?

~~A~~ 5Ω
~~B~~ 9Ω

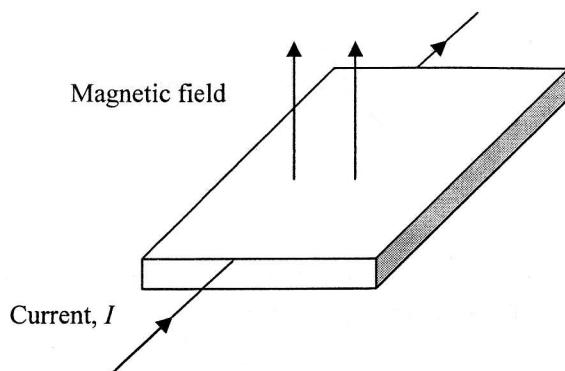
C 15Ω
D 18Ω

- 31 Two long parallel and free moving conductors are placed at a distance of 3 cm from each other. A direct current of 2.5 A flows through both conductors in the opposite direction. They will

~~A~~ remain stationary.
~~B~~ move away from each other.

C move towards each other.
D rotate in a clockwise direction

- 32 The diagram shows a horizontal piece of copper placed in a vertical magnetic field. A current I flows in the copper in the direction as shown.



$V_H = B v w$
 $v = \frac{I}{Aen}$

The Hall voltage produced in the conductor is independent of

~~A~~ charge carrier density in the conductor. ✓
~~B~~ length of the conductor
C magnetic flux density of the magnetic field. ✓
D temperature of the conductor

33 The magnitude of the induced e.m.f in a solenoid increases when

- A a magnet is moved slowly towards the solenoid
- B the solenoid remains stationary in a uniform magnetic field.
- ☒ C the number of turns of the solenoid increases. ✓
- D the solenoid and a magnet move in the same direction and parallel to one another.

34 A steady current of 2.0 A flows in a solenoid of inductance 4.0 H. The energy stored in the solenoid is

- A 2.0 J
- B 4.0 J
- ☒ C 8.0 J
- D 16.0 J

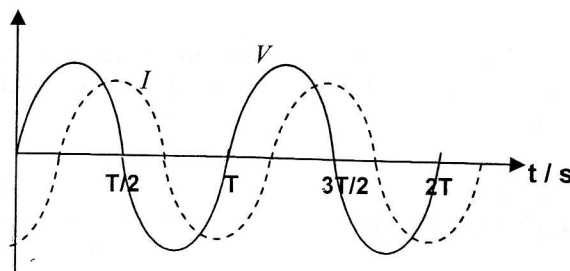
Handwritten calculations:

$$E = \frac{1}{2} LI^2$$

$$= \frac{1}{2} (4)(2)^2$$

$$= 8.0 \text{ J}$$

35 The figure shows the variation of an alternating voltage V and current I with time t in a pure inductor.



The current I leads the voltage V by

- A $\frac{\pi}{2}$ radians
- ☒ C $-\frac{\pi}{2}$ radians
- B π radians
- D $-\pi$ radians

36 A sinusoidal alternating voltage $V = V_0 \sin \omega t$ is connected across a pure capacitor of capacitance C . Maximum energy stored in the capacitor is

- ☒ A zero
- ☐ B $\frac{1}{2} C V_0^2$
- C $C V_0^2$
- D $2 C V_0^2$

37 A non-inverting amplifier contains a feedback resistance R_F in the circuit. What is the function of the feedback?

- ☒ A To increase the gain.
- B To increase the effect of distortion.
- ☒ C To increase the bandwidth.
- D To oppose the input voltage.

- 38 Which of the following is true concerning the difference between a mechanical wave and an electromagnetic wave?

Mechanical wave

☒ A Can propagate in vacuum

☐ B Has high frequency

☐ C Longitudinal waves or transverse waves only

☒ D Propagate with speed lower than the speed of light

Electromagnetic wave

Cannot propagate in vacuum

Has low frequency

Longitudinal waves only

Propagate with speed equal to the speed of light

- 39 An object is placed 10 cm from a concave mirror having a radius of curvature 40 cm. The image formed is

☐ A 13.5 cm in front of the mirror and is reduced in size.

☐ B 13.5 cm at the back of the mirror and is enlarged.

☐ C 20.0 cm in front of the mirror and is reduced in size

☒ D 20.0 cm at the back of the mirror and is enlarged.

Handwritten notes for Q39:

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\frac{1}{20} = \frac{1}{10} + \frac{1}{v}$$

$$\frac{1}{v} = \frac{1}{20} - \frac{1}{10} = -\frac{1}{20}$$

$$v = -20$$

- 40 The figure represents a graph of image distance, v , against object distance, u , for a convex lens of focal length, f .

Handwritten note for Q40:

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

When $u = v$

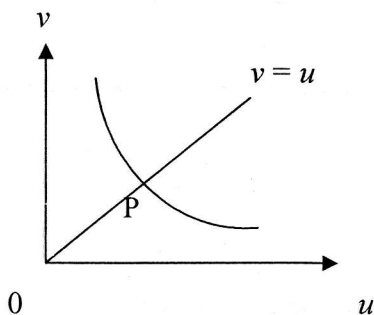
Handwritten note for Q40:

$$\frac{1}{f} = \frac{2}{u} \Rightarrow \frac{2}{v}$$

Handwritten note for Q40:

$$u = 2f$$

$$v = 2f$$



Handwritten notes for Q40:

$$M = \frac{v}{u}$$

$$\frac{v}{u}$$

The coordinates of point P is

☐ A $(\frac{1}{2}f, \frac{1}{2}f)$

☒ B (f, f)

☐ C $(2f, 2f)$

☒ D $(4f, 4f)$

- 41 What happens to the diffraction pattern of a single slit when the slit width is reduced?

Intensity of central peak

☐ A Decreases

☐ B Increases

☒ C Decreases

☒ D Increases

Width of diffraction pattern

Decreases

Decreases

Increases

Increases

Handwritten notes for Q41:

$$I = I_0 \left(\frac{\sin \alpha}{\alpha} \right)^2$$

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$$hf = eV + \phi$$

$$\frac{hc}{\lambda} = eV + \phi$$

$$\frac{(6.63 \times 10^{-34})(3.0 \times 10^8)}{(5.0 \times 10^{-9})} = W + e(0.50) \quad \text{--- (1)}$$

$$\frac{(6.63 \times 10^{-34})(3.0 \times 10^8)}{\lambda} = W + e(1.50) \quad \text{--- (2)}$$

$$\text{--- (1) --- (2)} \quad \lambda = 392 \text{ nm}$$

$$\frac{4.8}{1.18} = \frac{7}{(5W) \quad \text{--- (3)}}$$

$$\frac{0.8}{1.58} = \frac{1}{(3W) \quad \text{--- (4)}}$$

42 The surface of a lens can be made non-reflective by coating the lens surface with a thin layer of transparent material. If λ is the wavelength of the incident light in the medium, the minimum thickness, t , of the material required is

A $\frac{\lambda}{8}$

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

~~B $\frac{\lambda}{4}$~~

D λ

$$\lambda = \frac{4}{4} \quad t = \frac{\lambda}{4}$$

$$\frac{\lambda}{4} \quad t = \frac{\lambda}{4}$$

$$\frac{520}{0.80} = \frac{1}{(3W) \quad \text{--- (5)}}$$

$$\frac{1.58}{1.58} = \frac{1}{(3W) \quad \text{--- (6)}}$$

$$\sqrt{\lambda} \quad \frac{1}{\sqrt{\lambda}}$$

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43 When a metal surface is illuminated with light of wavelength 520 nm, the stopping potential required is 0.80 V. If light of wavelength λ is used, the stopping potential is 1.58 V. what is the value of λ ?

- (A) 392 nm
(B) 592 nm

- (C) 654 nm
(D) 684 nm

$$hf = eV + \phi$$

$$\frac{hc}{\lambda} = eV + \phi$$

$$\frac{(6.63 \times 10^{-34})(3.0 \times 10^8)}{520 \times 10^{-9}} = W + e(0.80) \quad \text{--- (7)}$$

$$= W + e(1.58) \quad \text{--- (8)}$$

$$\frac{0.8}{1.58} = \frac{1}{(3W) \quad \text{--- (9)}}$$

$$\frac{hc}{\lambda}$$

$$eV$$

$$eV = \frac{1}{2}mv^2$$

$$eV = \frac{1}{2}mv^2$$

$$v = \frac{h}{m\lambda}$$

44 If de Broglie wavelengths of each of the following particles are the same, which particle has the greatest speed?

- (A) electron
(B) Helium nucleus

- (C) proton
(D) α - particle

45 The energy levels in a hydrogen atom are given by $E = -\frac{13.6}{n^2}$ eV where $n = 1, 2, 3, \dots$. The energy required to excite an electron from the ground state to the first excited state is

- A 3.4 eV
B 4.5 eV

- ~~C 10.2 eV~~
D 13.6 eV

$$\frac{13.6}{1} = 13.6 \text{ eV}$$

46 What happens when the potential difference in an X-ray tube is increased?

- (A) Minimum wavelength, λ_{min} Decreases
(B) Increases
(C) Increases
(D) Remains unchanged

- Intensity of continuous spectrum
Increases
Remains unchanged
Increases
Decreases

$$\frac{hc}{\lambda}$$

47 The following are characteristics of laser *except*

- ~~A coherent~~
~~B highly divergent~~

- C highly focused
D monochromatic

- 48 The half-life of a radioactive nuclide is such that $\frac{3}{4}$ of a given number of atoms in a sample decays in 12 hours. What fraction remains undecayed after 18 hours?

☒ A $\frac{1}{8}$

B $\frac{1}{4}$

~~C $\frac{3}{8}$~~

~~D $\frac{1}{2}$~~

$$e^{-\lambda t} = \frac{N}{N_0}$$

$$\frac{N}{N_0} = \frac{1}{4} = e^{-\lambda t}$$

$$\frac{1}{4} = e^{-\lambda(12)}$$

$$\ln \frac{1}{4} = -\lambda(12)$$

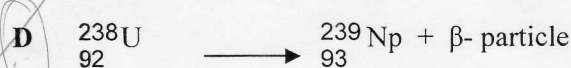
$$\lambda = \frac{\ln 4}{12}$$

After 18 hours,

$$\frac{N}{N_0} = e^{-\left(\frac{\ln 4}{12}\right)(18)}$$

$$\frac{N}{N_0} = 0.125 = \frac{1}{8}$$

- 49 Which of the following radioactivity is **not** likely to occur?



- 50 Which of the following are leptons?

A proton and electron

B proton and pion

~~C sigma and tau~~

~~D muon and neutrino~~

$$\frac{1}{8} \longrightarrow \frac{1}{2} \longrightarrow \frac{1}{4} \longrightarrow \frac{1}{8}$$