

IEA - Data Enhancement Project

Questionnaire printing

Study: SC2

Population: 3

Instrument: STP_3

Student Achievement Test Physics (3P)

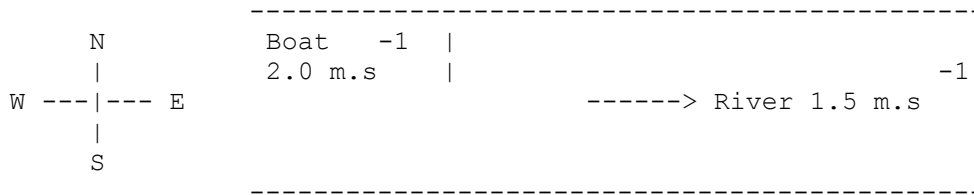
Population 3

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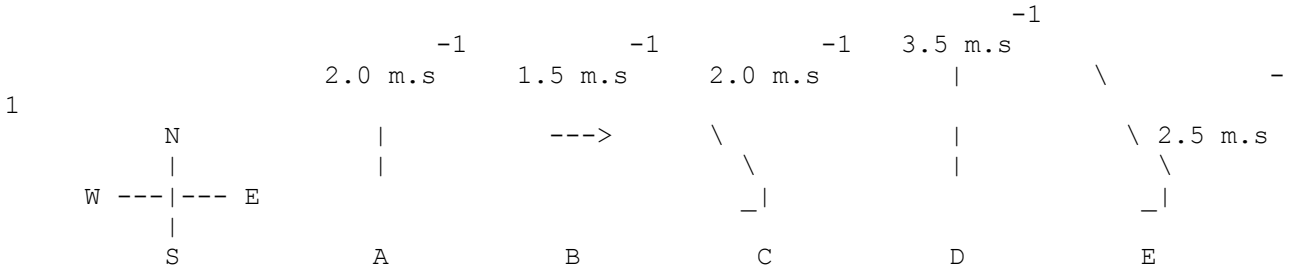
3

A river flows due East at 1.5 m.s⁻¹

A motor boat leaves the North bank and heads due South at 2.0 m.s⁻¹



Which of the vectors below best represents the velocity of the boat relative to the river bank?



P3P03

4 A stone is dropped from rest down a deep well. It takes 2 s to reach the bottom. How deep is the well?

Assume that the air resistance on the falling stone is negligible and that the acceleration due to gravity $g = 9.8 \text{ m.s}^{-2}$

- A 4.9 m
- B 9.8 m
- C 19.6 m
- D 39.2 m
- E 78.4 m

P3P04

5

-1

Car A moving in a straight line at a constant velocity of 20 m.s
is initially 200 m behind Car B moving in the same straight line at a
constant velocity of 15 m.s

How far must Car A travel from this initial position before it
catches up with Car B?

- A 200 m
- B 400 m
- C 600 m
- D 800 m
- E 1000 m

P3P05

6

Object mass = 10 kg

Some of this information may be useful:

[Picture]

$\sin 30^\circ = 0.50$ $\sin 60^\circ = 0.87$
 $\cos 30^\circ = 0.87$ $\cos 60^\circ = 0.50$

2

Acceleration due to gravity $g = 9.8 \text{ m.s}^{-2}$

An object of mass 10 kg is to be held at rest on a flat surface which is
inclined at 30° to the horizontal. Assume that there are no frictional
forces between the object and the inclined surface. What is the value
of the minimum force F acting parallel to the surface which is needed to
prevent the object from sliding down the inclined surface?

- A 10 N
- B 49 N
- C 85 N
- D 98 N
- E 196 N

P3P06

7

-1

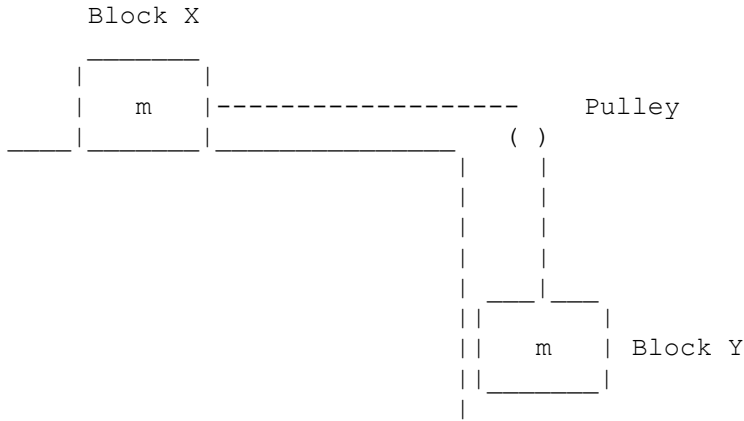
Ball A of mass 5 kg moving at 20 m.s collides with Ball B of unknown
mass moving at 10 m.s in the same direction. After collision, Ball A
moves at 10 m.s and Ball B at 15 m.s, both still in the same direction.

What is the mass of Ball B?

- A 2 kg
- B 6 kg
- C 10 kg
- D 12 kg
- E 30 kg

P3P07

8



A rope is attached to two blocks of equal mass m as shown in the diagram. Block X is initially held at rest on a flat horizontal frictionless surface, and the rope passes over a pulley. When Block X is released, what is the acceleration of Block Y?

- A zero
- B $g/2$
- C g
- D $\sqrt{2} g$
- E $2g$

P3P08

9

Acceleration due to
gravity = g

[Picture]

An aircraft flies in a vertical circular path of radius R at a constant speed. When the aircraft is at the top of the circular path the passengers feel "weightless". What is the speed of the aircraft?

- A gR
- B \sqrt{gR}
- C g/R
- D $\sqrt{g/R}$
- E $2gR$

P3P09

- 13 In an imaginary situation, a 1 kg block of ice at 0 °C is dropped from such a height that all of it is melted by the heat generated on impact with the ground. From what height would a 25 kg block of ice have to be dropped to melt completely? Assume that in both cases all of the heat produced is absorbed by the ice?
- A 1/5 as high
 - B 1/25 as high
 - C the same height
 - D 5 times as high
 - E 25 times as high

P3P13

- 14 A sensitive mercury-in-glass thermometer registering room temperature is immersed in boiling water. The mercury level first drops slightly and then rises. Why does the drop occur?
- A The specific heat of glass is greater than that of mercury.
 - B The coefficient of expansion is greater for glass than for mercury.
 - C The glass expands before the mercury does.
 - D At room temperature, mercury has a negative coefficient of expansion like that of water from 0 °C to 4 °C.
 - E The surface tension of mercury increases with temperature.

P3P14

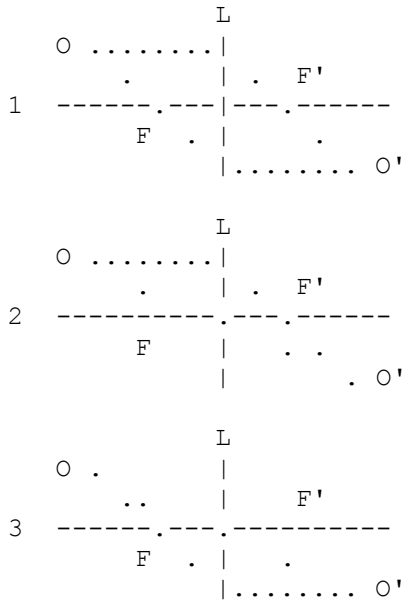
- 15 A 1500 watt electric water heater can heat 2 kg of water from 15 °C to 35 °C in 140 seconds. Find the efficiency of the heater. Assume that 4200 joules of heat energy are needed to increase the temperature of 1 kg of water by 1 °C.
- A 20 per cent
 - B 40 per cent
 - C 80 per cent
 - D 100 per cent
 - E 125 per cent

P3P15

- 16 A jar of oxygen gas and a jar of hydrogen gas are at the same temperature. Which one of the following has the same value for the molecules of both gases?
- A the average velocity
 - B the average momentum
 - C the average force
 - D the average potential energy
 - E the average kinetic energy

P3P16

17 The three Diagrams 1, 2, 3, give the graphical construction for image O' of object O as produced by the thin lens L with foci F and F'.



Which, if any, of these three diagrams are correct?

- A Only Diagrams 2 and 3 are correct.
- B Only Diagrams 1 and 3 are correct.
- C Only Diagrams 1 and 2 are correct.
- D None of the diagrams are correct.
- E All three diagrams are correct.

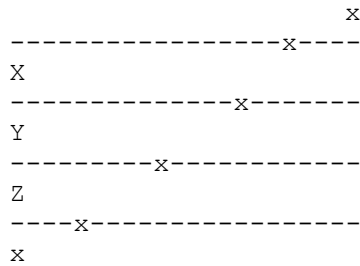
P3P17

18 The sketch shows the pattern of circular waves produced by a moving source S in a tank of water. Sound can be described as a wave motion and that the pitch of a particular sound becomes higher with an increase in frequency. Which of the following phenomena might be predicted from this pattern?

- A The intensity of sound from a moving source varies inversely as the square of the distance from the source. - -
- B The pitch of a musical note from a vibrating string varies with the tension of the string. ^ | * S
- C The sound of a passing automobile horn to an observer by the side of a road drops in pitch as the car passes. - -
- D The velocity of propagation of sound waves increases without a change in pitch as the sound passes into a denser medium. - -
- E The second harmonic is equal to twice the fundamental frequency. - -

P3P18

- 19 A ray of blue light passes through a stack of three parallel-sided blocks made of different materials. The path of the beam is shown. In which of the three blocks is the velocity of blue light greatest?

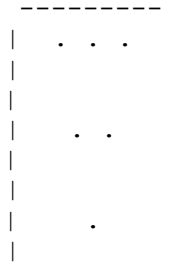


- A X
 B Y
 C Z
 D The velocity is the same in all the blocks.
 E The information given is insufficient to be able to say.

P3P19

- 20 A screen with a fine wedge-shaped slit as shown in the diagram is set up in a plane parallel to a photographic plate. A narrow beam of monochromatic light is sent through the slit and falls on the plate. What is the shape of the exposed area of the plate?

- A a wedge of the same shape and size as the wedge used
 B a wedge widened uniformly by diffraction
 C a wedge narrowed uniformly by diffraction
 D a wedge widened most at the bottom by diffraction
 E a wedge narrowed most at the bottom by diffraction



P3P20

- 21 Hertz detected radiations by means of a spark detector. When he placed his receiver between the source of radiation and a metal sheet, he found that the strongest sparks resulted at multiples of a certain distance from the reflecting sheet. Which one of the following can be concluded from this experiment about the nature of the radiations?

- A They consisted of transverse waves.
 B They consisted of longitudinal waves.
 C They consisted of waves, but gives no indication as to whether they are transverse or longitudinal.
 D They consisted of ultrasonic radiation.
 E They consisted of some form of energy moving through air with the speed of light.

P3P21

22 In the spectrum of the sun a continuous spectrum is crossed by many black lines (Fraunhofer lines). Which of the following statements is correct?

- A The black lines are caused by Fraunhofer diffraction at the telescope.
- B The black lines are caused by the absorption of light by the gases of the Sun's atmosphere.
- C The spectrum of the Sun lacks the spectral lines of all the elements present in the Sun.
- D The black lines come from the combustion of elements at the Sun.
- E The spectrum of the Sun is changed in the space between Sun and Earth by cosmic radiation.

P3P22

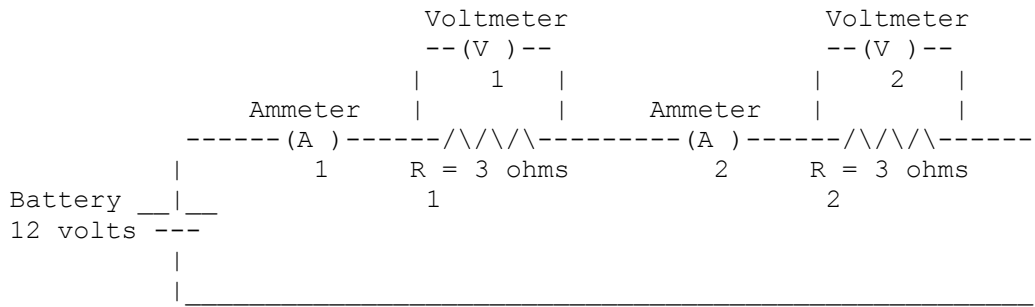
23 Two small charges of $+2 \mu\text{C}$ (micro-coulombs) and $-6 \mu\text{C}$ respectively are placed 4 cm apart as shown. Where should a third charge $-8 \mu\text{C}$ be placed so that there is no net force on the $-6 \mu\text{C}$ charge?



- A 4 cm left of the $-6 \mu\text{C}$ charge
- B 16 cm left of the $-6 \mu\text{C}$ charge
- C 16 cm right of the $-6 \mu\text{C}$ charge
- D 8 cm left of the $-6 \mu\text{C}$ charge
- E 8 cm right of the $-6 \mu\text{C}$ charge

P3P23

24 This question is based on the circuit represented by the diagram below.

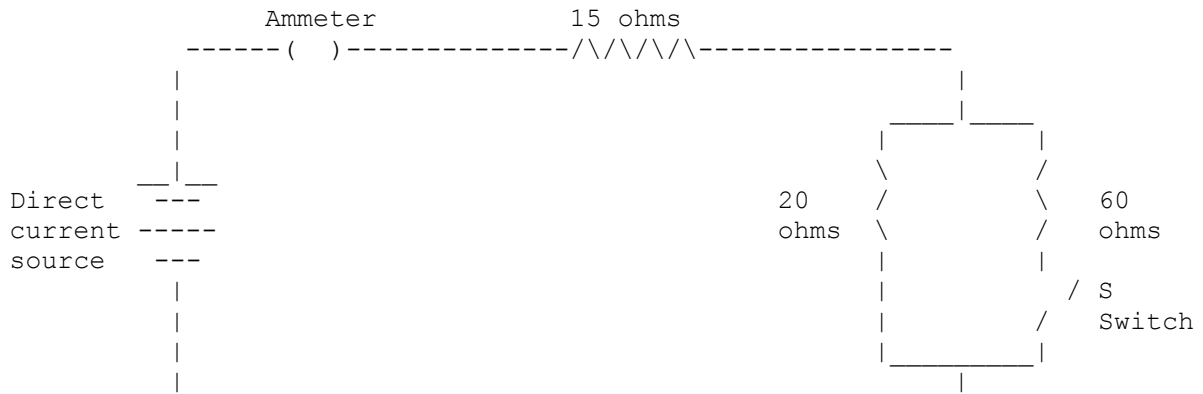


Which one of the following sets of results would be observed?

Set	Ammeter A 1	Voltmeter V 1	Ammeter A 2	Voltmeter V 2
A	1 amp	6 volts	1 amp	6 volts
B	1 amp	12 volts	1 amp	12 volts
C	1 amp	6 volts	2 amps	12 volts
D	2 amps	6 volts	2 amps	6 volts
E	2 amps	12 volts	2 amps	12 volts

P3P24

25 The following diagram represents an electric circuit



When the switch S is open the reading on the ammeter A is 2.0 amperes. When the switch is closed, what happens to the reading on the ammeter?

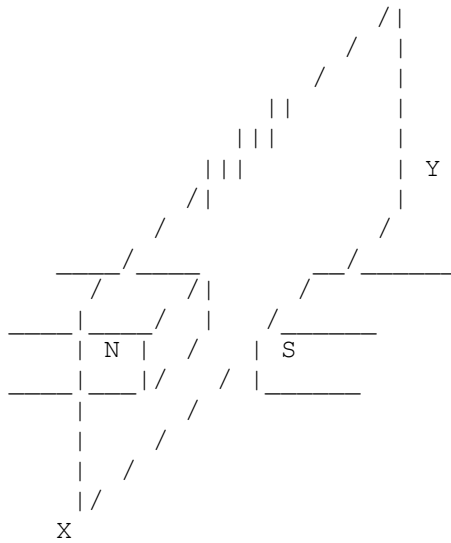
- A It would halve.
- B It would decrease slightly.
- C It would remain the same.
- D It would increase slightly.
- E It would double.

P3P25

- 26 Under which of the following circumstances is an electromotive force (EMF) *not* induced in a conductor in a uniform magnetic field?
- A The magnetic field is moving at right angles to the conductor.
 - B The conductor is moving at right angles to the magnetic field.
 - C The magnetic field and the conductor are relatively stationary, but the magnetic field is increasing.
 - D The conductor is moving parallel to the magnetic field.
 - E The magnetic field and the conductor are stationary relative to each other, but the magnetic field is dying away to zero.

P3P26

- 27 A wire with an electric current passing through it is placed in a magnetic field as shown in the diagram.



In which direction will the wire move?

- A towards the North pole
- B towards the South pole
- C vertically up
- D vertically down
- E in the direction of point Y

P3P27

- 28 What happens if a photon collides with a free electron?

- A Energy is conserved; momentum is not.
- B Momentum is conserved; energy is not.
- C Both energy and momentum are conserved.
- D Neither energy nor momentum need be conserved.
- E Momentum is conserved; the nature of the collision determines whether energy is conserved.

P3P28

29

Which one of the following particles may be represented by the symbol ${}^0_{-1}\text{X}$?

- A an electron
- B an alpha particle
- C a neutron
- D a proton
- E a positron

P3P29

30 An atom with atomic number Z and atomic mass (mass number) W changes into one with atomic number $Z + 1$ and atomic mass W . Which of the following nuclear changes could have taken place?

- A the emission of an alpha particle
- B the emission of a beta particle
- C the emission of gamma rays
- D the absorption of a deuteron and then emission of a neutron
- E the absorption of a neutron and the emission of a gamma photon

P3P30
