# R2019_810P1 *[90 marks]*

1. What is the function of control rods in a nuclear power plant?   *[1 mark]*

    A. To slow neutrons down
    B. To regulate fuel supply
    C. To exchange thermal energy
    D. To regulate the reaction rate

2. A photovoltaic panel of area S has an efficiency of 20 %. A second photovoltaic panel   *[1 mark]*
    has an efficiency of 15 %. What is the area of the second panel so that both panels
   produce the same power under the same conditions?

    A. $\frac{S}{3}$
    B. $\frac{3S}{4}$
    C. $\frac{5S}{4}$
    D. $\frac{4S}{3}$

3. Light of intensity I_0 is incident on a snow-covered area of Earth. In a model of this   *[1 mark]*
    situation, the albedo of the cloud is 0.30 and the albedo for the snow surface is 0.80.
    What is the intensity of the light at P due to the incident ray I_0?
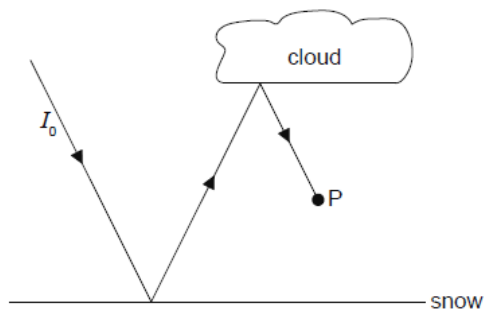
    A. 0.14 I_0
    B. 0.24 I_0
    C. 0.50 I_0
    D. 0.55 I_0

4. Two point charges Q_1 and Q_2 are one metre apart. The graph shows the variation [1 mark]
of electric potential V with distance x from Q_1.
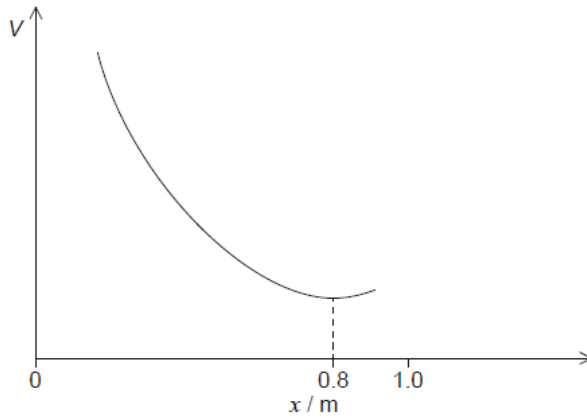
What is $\dfrac{Q_1}{Q_2}$?

A. $\dfrac{1}{16}$

B. $\dfrac{1}{4}$

C. 4

D. 16

5. The gravitational potential at point P due to Earth is V. [1 mark]

What is the definition of the gravitational potential at P?

A. Work done per unit mass to move a point mass from infinity to P

B. Work done per unit mass to move a point mass from P to infinity

C. Work done to move a point mass from infinity to P

D. Work done to move a point mass from P to infinity

6. The escape speed for the Earth is v_{esc}. Planet X has half the density of the Earth and [1 mark]
twice the radius. What is the escape speed for planet X?

A. $\dfrac{v_{esc}}{2}$

B. $\dfrac{v_{esc}}{\sqrt{2}}$

C. v_{esc}

D. $\sqrt{2}\, v_{esc}$

7. What is equivalent to $\dfrac{\text{specific energy of a fuel}}{\text{energy density of a fuel}}$? *[1 mark]*

   A. density of the fuel

   B. $\dfrac{1}{\text{density of the fuel}}$

   C. $\dfrac{\text{energy stored in the fuel}}{\text{density of the fuel}}$

   D. $\dfrac{\text{density of the fuel}}{\text{energy stored in the fuel}}$

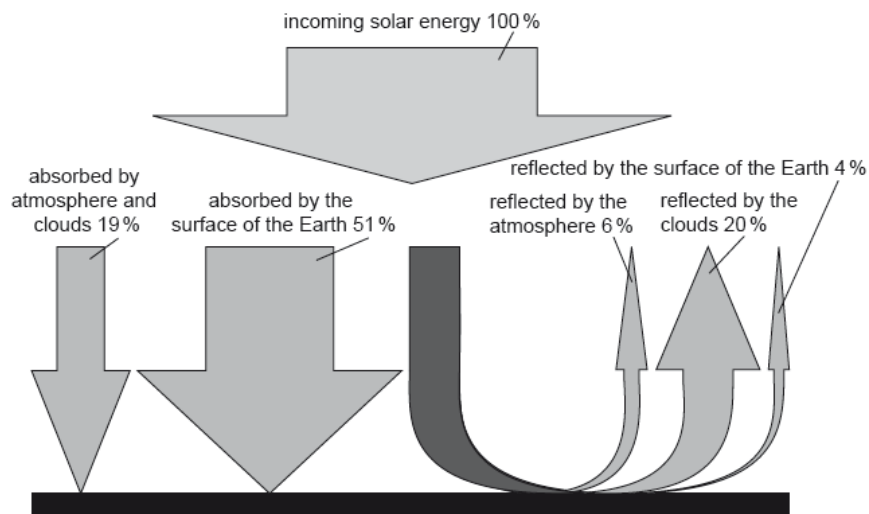8. Three energy sources for power stations are *[1 mark]*

   I. fossil fuel

   II. pumped water storage

   III. nuclear fuel.

   Which energy sources are primary sources?

   A. I and II only

   B. I and III only

   C. II and III only

   D. I, II and III

9. The diagram shows a simple climate model for the Earth. *[1 mark]*

   incoming solar energy 100 %

   absorbed by atmosphere and clouds 19 %

   absorbed by the surface of the Earth 51 %

   reflected by the surface of the Earth 4 %

   reflected by the atmosphere 6 %

   reflected by the clouds 20 %

   What does this model predict for the average albedo of the Earth?

   A. 0.30

   B. 0.51

   C. 0.70

   D. 0.81

10. A wind turbine has a power output p when the wind speed is v. The efficiency of the wind turbine does not change. What is the wind speed at which the power output is $\frac{p}{2}$?   *[1 mark]*

A. $\frac{v}{4}$

B. $\frac{v}{\sqrt{8}}$

C. $\frac{v}{2}$

D. $\frac{v}{\sqrt[3]{2}}$

11. Three gases in the atmosphere are   *[1 mark]*

      I.   carbon dioxide (CO_2)

      II.   dinitrogen monoxide (N_2O)

      III. oxygen (O_2).

Which of these are considered to be greenhouse gases?

A.   I and II only

B.   I and III only

C.   II and III only

D.   I, II and III

12. Mars and Earth act as black bodies. The $\dfrac{\text{power radiated by Mars}}{\text{power radiated by the Earth}} = p$ and   *[1 mark]*
$\dfrac{\text{absolute mean temperature of the surface of Mars}}{\text{absolute mean temperature of the surface of the Earth}} = t.$

What is the value of $\dfrac{\text{radius of Mars}}{\text{radius of the Earth}}$?

A. $\dfrac{p}{t^4}$

B. $\dfrac{\sqrt{p}}{t^2}$

C. $\dfrac{t^4}{p}$

D. $\dfrac{t^2}{\sqrt{p}}$

13. A nuclear reactor contains atoms that are used for moderation and atoms that are used for control.   *[1 mark]*

What are the ideal properties of the moderator atoms and the control atoms in terms of neutron absorption?

	Ideal moderator atom	Ideal control atom
A.	poor absorber of neutrons	poor absorber of neutrons
B.	poor absorber of neutrons	good absorber of neutrons
C.	good absorber of neutrons	poor absorber of neutrons
D.	good absorber of neutrons	good absorber of neutrons

14. The dashed line on the graph shows the variation with wavelength of the intensity of solar radiation before passing through the Earth's atmosphere. [1 mark]

The solid line on the graph shows the variation with wavelength of the intensity of solar radiation after it has passed through the Earth's atmosphere.
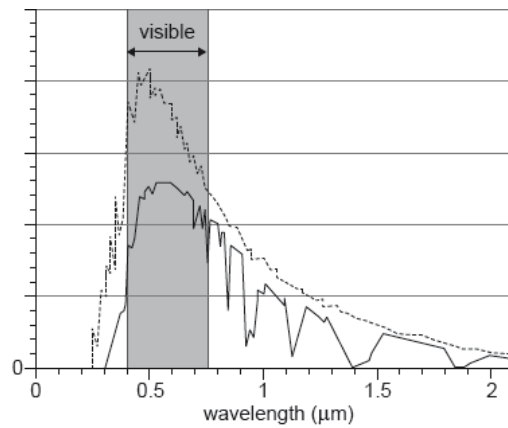
[Source: Reproduced by permission of Martin Green, UNSW Sydney]

Which feature of the graph helps explain the greenhouse effect?

A.   Infrared radiation is absorbed at specific wavelengths.

B.   There is little absorption at infrared wavelengths.

C.   There is substantial absorption at visible wavelengths.

D.   There is little absorption at UV wavelengths.

15. Four identical, positive, point charges of magnitude Q are placed at the vertices of a square of side $2d$. What is the electric potential produced at the centre of the square by the four charges? [1 mark]
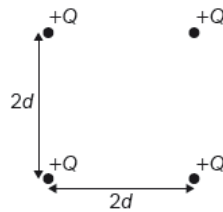
A.   0

B. $\dfrac{4kQ}{d}$

C. $\dfrac{\sqrt{2}kQ}{d}$

D. $\dfrac{2\sqrt{2}kQ}{d}$

16. The diagram shows 5 gravitational equipotential lines. The gravitational potential on   [1 mark]
each line is indicated. A point mass *m* is placed on the middle line and is then released.
Values given in MJ kg⁻¹.

$$• m$$

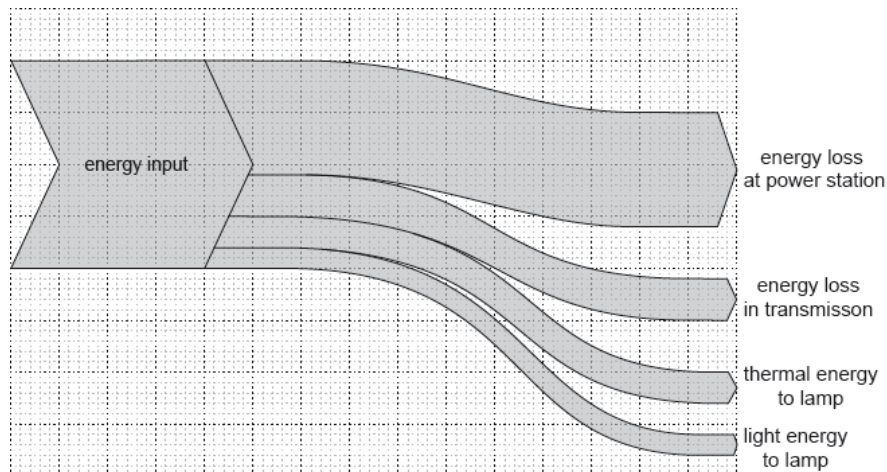−10 −8   −6   −4   −2
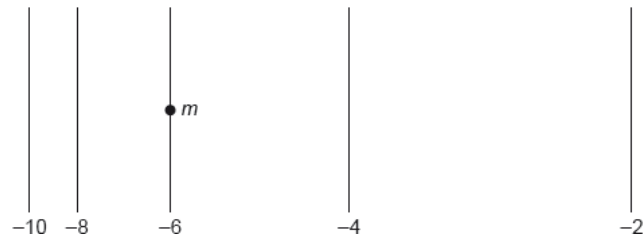
Which is correct about the direction of motion and the acceleration of the point mass?

	Direction	Acceleration
A.	to the right	decreasing
B.	to the right	increasing
C.	to the left	decreasing
D.	to the left	increasing

17. An electron of mass m_e orbits an alpha particle of mass m_α in a circular orbit of radius r.[1 mark]
Which expression gives the speed of the electron?

A. $\sqrt{\dfrac{2ke^2}{m_e r}}$

B. $\sqrt{\dfrac{2ke^2}{m_a r}}$

C. $\sqrt{\dfrac{4ke^2}{m_e r}}$

D. $\sqrt{\dfrac{4ke^2}{m_a r}}$

18. The Sankey diagram shows the energy input from fuel that is eventually converted to   [1 mark]
useful domestic energy in the form of light in a filament lamp.

energy input

energy loss
at power station

energy loss
in transmisson

thermal energy
to lamp

light energy
to lamp

What is true for this Sankey diagram?

A.   The overall efficiency of the process is 10%.

B.   Generation and transmission losses account for 55% of the energy input.

C.   Useful energy accounts for half of the transmission losses.

D.   The energy loss in the power station equals the energy that leaves it.

19. What part of a nuclear power station is principally responsible for increasing the chance *[1 mark]* that a neutron will cause fission?

    A.   Moderator

    B.   Control rod

    C.   Pressure vessel

    D.   Heat exchanger

20. A moon of mass M orbits a planet of mass $100\,M$. The radius of the planet is R and the *[1 mark]* distance between the centres of the planet and moon is $22R$.

    What is the distance from the centre of the planet at which the total gravitational potential has a maximum value?

    A. $2R$

    B. $11R$

    C. $20R$

    D. $2R$ and $20R$

21. The diagram shows the electric field and the electric equipotential surfaces between two *[1 mark]* charged parallel plates. The potential difference between the plates is 200 V.
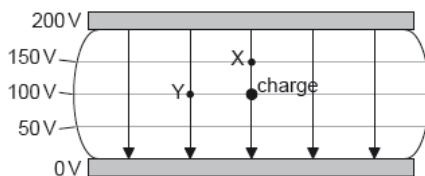
    What is the work done, in nJ, by the electric field in moving a negative charge of magnitude 1 nC from the position shown to X and to Y?

	To X	To Y
A.	50	0
B.	−50	0
C.	50	100
D.	−50	−100

22. A positive point charge is placed above a metal plate at zero electric potential. Which *[1 mark]* diagram shows the pattern of electric field lines between the charge and the plate?
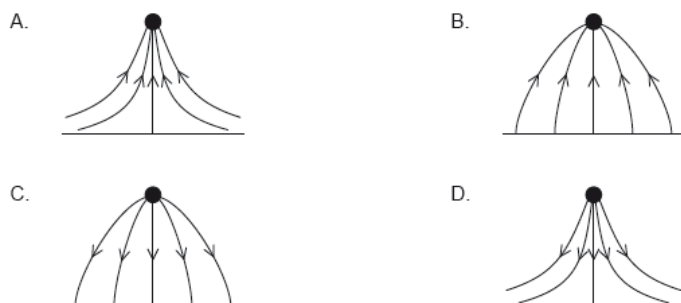
23. A satellite orbiting a planet moves from orbit X to orbit Y. *[1 mark]*
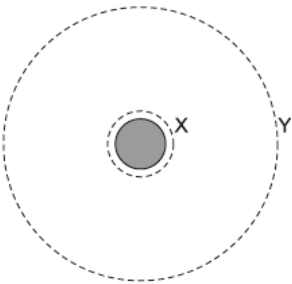
What is the change in the kinetic energy and the change in the gravitational potential energy as a result?

	Kinetic energy	Gravitational potential energy
A.	increases	increases
B.	increases	decreases
C.	decreases	increases
D.	decreases	decreases

24. The mass of the Earth is M_E and the mass of the Moon is M_M. Their respective radii are R_E and R_M. *[1 mark]*

Which is the ratio $\dfrac{\text{escape speed from the Earth}}{\text{escape speed from the Moon}}$?

A.
$$\sqrt{\frac{M_M R_M}{M_E R_E}}$$

B.
$$\sqrt{\frac{M_E R_E}{M_M R_M}}$$

C.
$$\sqrt{\frac{M_E R_M}{M_M R_E}}$$

D.
$$\sqrt{\frac{M_M R_E}{M_E R_M}}$$

25. Which of the energy sources are classified as renewable and non-renewable? *[1 mark]*

	Renewable	Non-renewable
A.	Sun	wind
B.	natural gas	geothermal
C.	biomass	crude oil
D.	uranium-235	coal

26. The energy density of a substance can be calculated by multiplying its specific energy *[1 mark]* with which quantity?

    A. mass

    B. volume

    C. $\frac{\text{mass}}{\text{volume}}$

    D. $\frac{\text{volume}}{\text{mass}}$

27. A black body emits radiation with its greatest intensity at a wavelength of I_{max}. The *[1 mark]* surface temperature of the black body doubles without any other change occurring. What is the wavelength at which the greatest intensity of radiation is emitted?

    A. I_{max}

    B. $\frac{I_{max}}{2}$

    C. $\frac{I_{max}}{4}$

    D. $\frac{I_{max}}{16}$

28. The three statements give possible reasons why an average value should be used for *[1 mark]* the solar constant.

    I.   The Sun's output varies during its 11 year cycle.
    II. The Earth is in elliptical orbit around the Sun.
    III. The plane of the Earth's spin on its axis is tilted to the plane of its orbit about the Sun.

    Which are the correct reasons for using an average value for the solar constant?

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II and III

29. A charge of –3 C is moved from A to B and then back to A. The electric potential at A is *[1 mark]* +10 V and the electric potential at B is –20 V. What is the work done in moving the charge from A to B and the total work done?

|	Work done in moving from A to B / J	Total work done / J
A.	30	0
B.	30	60
C.	90	0
D.	90	180

30. A spacecraft moves towards the Earth under the influence of the gravitational field of   *[1 mark]*
the Earth.

The three quantities that depend on the distance r of the spacecraft from the centre of the Earth are the

I. gravitational potential energy of the spacecraft
II   gravitational field strength acting on the spacecraft
III. gravitational force acting on the spacecraft.

Which of the quantities are proportional to $\frac{1}{r^2}$?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

31. An isolated hollow metal sphere of radius R carries a positive charge. Which graph   *[1 mark]*
shows the variation of potential V with distance x from the centre of the sphere?
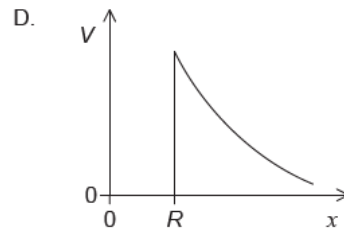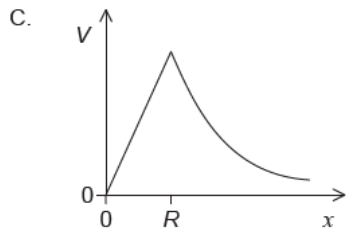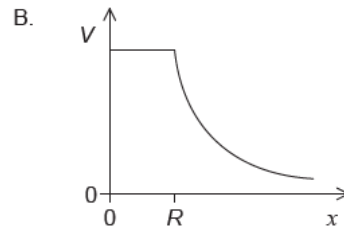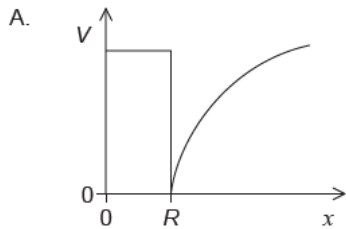
32. Two pulses are travelling towards each other. *[1 mark]*
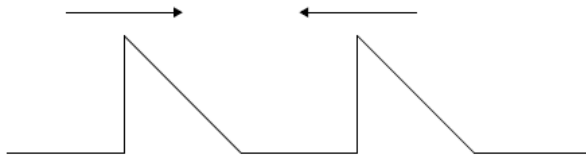
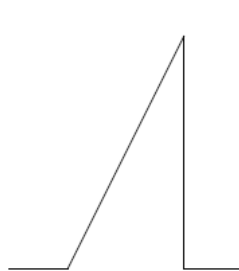What is a possible pulse shape when the pulses overlap?

A.
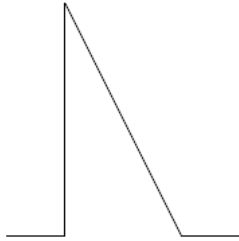
B.
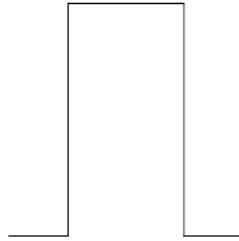
C.

D.

33. The following are energy sources. *[1 mark]*

I.   a battery of rechargeable electric cells
II. crude oil
III. a pumped storage hydroelectric system

Which of these are secondary energy sources?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

34. Planet X and planet Y both emit radiation as black bodies. Planet X has a surface temperature that is less than the surface temperature of planet Y.   [1 mark]

What is the graph of the variation of intensity I with wavelength λ for the radiation emitted by planet Y? The graph for planet X is shown dotted.

A.

B.

C.

D.
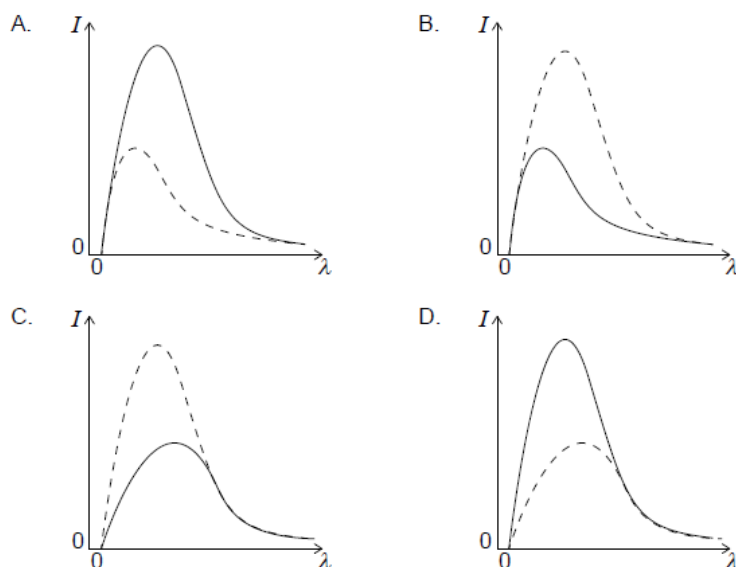
35. The average surface temperature of Mars is approximately 200 K and the average surface temperature of Earth is approximately 300 K. Mars has a radius half that of Earth. Assume that both Mars and Earth act as black bodies.   [1 mark]

What is $\dfrac{\text{power radiated by Mars}}{\text{power radiated by Earth}}$?

A. 20
B. 5
C. 0.2
D. 0.05

36. The main role of a moderator in a nuclear fission reactor is to   [1 mark]

A. slow down neutrons.

B. absorb neutrons.

C. reflect neutrons back to the reactor.

D. accelerate neutrons.

37. A room is at a constant temperature of 300 K. A hotplate in the room is at a temperature of 400 K and loses energy by radiation at a rate of P. What is the rate of loss of energy from the hotplate when its temperature is 500 K?   [1 mark]

A. $\dfrac{4^4}{5^4}P$

B. $\dfrac{5^4+3^4}{4^4+3^4}P$

C. $\dfrac{5^4}{4^4}P$

D. $\dfrac{5^4-3^4}{4^4-3^4}P$

38. An object can lose energy through   *[1 mark]*

   I.   conduction
   II. convection
   III. radiation

   What are the principal means for losing energy for a hot rock resting on the surface of the Moon?

   A. I and II only

   B. I and III only

   C. II and III only

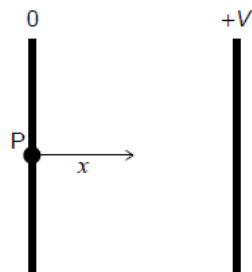   D. I, II and III

39. The average albedo of glacier ice is 0.25.   *[1 mark]*

   What is $\dfrac{\text{power absorbed by glacier ice}}{\text{power reflected by glacier ice}}$?

   A. 0.25

   B. 0.33

   C. 2.5

   D. 3.0

40. An electric field acts in the space between two charged parallel plates. One plate is at   *[1 mark]*
    zero potential and the other is at potential $+V$.

   The distance x is measured from point P in the direction perpendicular to the plate.

   What is the dependence of the electric field strength E on x and what is the dependence of the electric potential V on x?

	E	V
A.	proportional to $\dfrac{1}{x^2}$	constant
B.	constant	proportional to x
C.	proportional to x	proportional to x
D.	proportional to x^2	constant

41. A satellite at the surface of the Earth has a weight W and gravitational potential energy *[1 mark]* Ep. The satellite is then placed in a circular orbit with a radius twice that of the Earth.

What is the weight of the satellite and the gravitational potential energy of the satellite when placed in orbit?

	Weight	Gravitational potential energy
A.	$0.25\,W$	$0.25\,E_p$
B.	$0.5\,W$	$0.25\,E_p$
C.	$0.25\,W$	$0.5\,E_p$
D.	$0.5\,W$	$0.5\,E_p$

42. Two point charges are at rest as shown. *[1 mark]*

At which position is the electric field strength greatest?

C.

A. ● B. ● D.
    $+5\,\mu C$ $-2.5\,\mu C$

43. A positive charge Q is deposited on the surface of a small sphere. The dotted lines *[1 mark]* represent equipotentials.
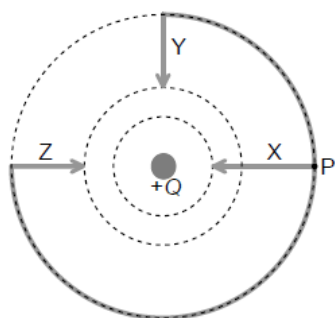
A small positive point charge is moved from point P closer to the sphere along three different paths X, Y and Z. The work done along each path is W_X, W_Y and W_Z. What is a correct comparison of W_X, W_Y and W_Z?

A. $W_Z > W_Y > W_X$

B. $W_X > W_Y = W_Z$

C. $W_X = W_Y = W_Z$

D. $W_Z = W_Y > W_X$

44. The graph shows the variation of the gravitational potential V with distance r from the *[1 mark]*
centre of a uniform spherical planet. The radius of the planet is R. The shaded area is
S.

distance r

gravitational potential V
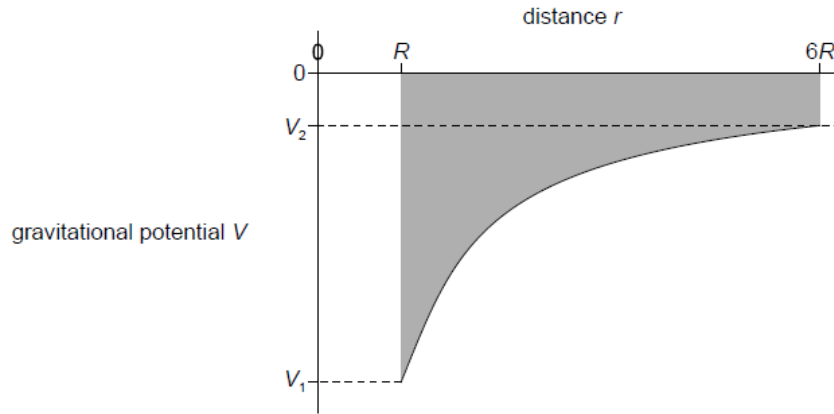
What is the work done by the gravitational force as a point mass m is moved from the surface
of the planet to a distance $6R$ from the centre?

A. $m(V2 - V1)$

B. $m(V1 - V2)$

C. mS

D. S

45. Four uniform planets have masses and radii as shown. Which planet has the *[1 mark]*
smallest escape speed?

A.

M, R

B.

$2M, R$

C.

$M, 2R$

D.

$2M, 2R$
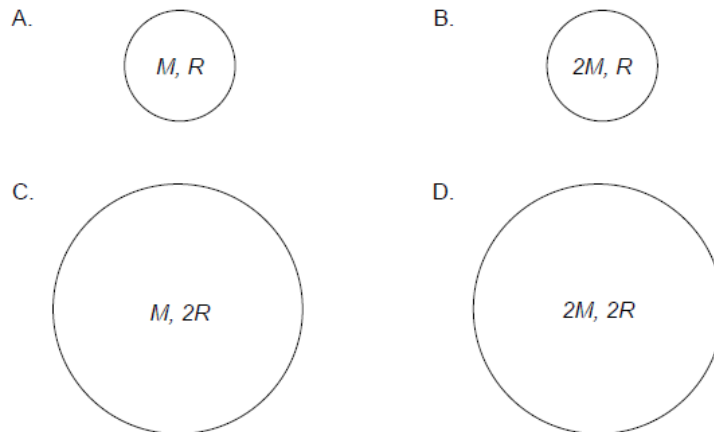
46. The Sankey diagram represents the energy flow for a coal-fired power station. *[1 mark]*
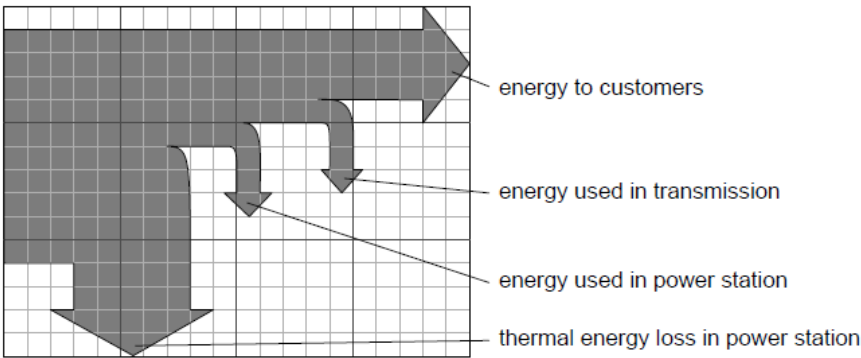
What is the overall efficiency of the power station?

A. 0.3

B. 0.4

C. 0.6

D. 0.7

47. Which of the following is **not** a primary energy source? *[1 mark]*

A. Wind turbine

B. Jet Engine

C. Coal-fired power station

D. Nuclear power station

48. What are the principal energy changes in a photovoltaic cell and in a solar heating panel? *[1 mark]*

	Photovoltaic cell	Solar heating panel
A.	solar to electrical	solar to thermal
B.	solar to thermal	solar to thermal
C.	solar to electrical	electrical to thermal
D.	solar to thermal	electrical to thermal

49. The solar constant is the intensity of the Sun's radiation at *[1 mark]*

A. the surface of the Earth.
B. the mean distance from the Sun of the Earth's orbit around the Sun.
C. the surface of the Sun.
D. 10km above the surface of the Earth.

50. X and Y are two spherical black-body radiators that emit the same total power. The absolute temperature of X is half that of Y.   [1 mark]

    What is $\frac{\text{radius of X}}{\text{radius of Y}}$?

    A. 4

    B. 8

    C. 16

    D. 32

51. What is the unit of $G\varepsilon_0$, where G is the gravitational constant and ε_0 is the permittivity of   [1 mark]
    free space?

    A. $C\ kg^{-1}$

    B. $C^2\ kg^{-2}$

    C. $C\ kg$

    D. $C^2\ kg^2$

52. Two parallel metal plates are connected to a dc power supply. An electric field forms in   [1 mark]
    the space between the plates as shown.
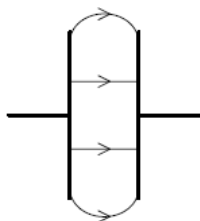
    What is the shape of the equipotentials surfaces that result from this arrangement?
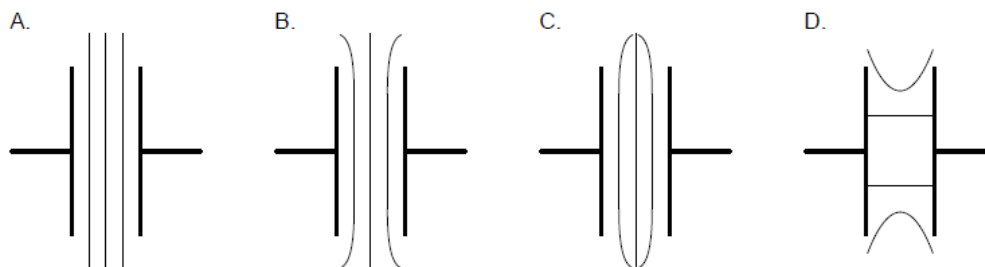
53. A satellite of mass 1500 kg is in the Earth's gravitational field. It moves from a point   [1 mark]
    where the gravitational potential is −30 MJ kg^{-1} to a point where the gravitational
    potential is −20 MJ kg^{-1}. What is the direction of movement of the satellite and the change in its
    gravitational potential energy?

	Direction of movement of satellite	Change in gravitational potential energy / GJ
A.	away from Earth	15
B.	away from Earth	75
C.	towards Earth	15
D.	towards Earth	75

54. A solar panel has surface area 0.40m^2 and efficiency 50%. The average intensity of radiation reaching the surface of the panel is 0.25kWm^{-2}. What is the average power output from an array of 10 of these solar panels? *[1 mark]*

   A. 0.5 W

   B. 5 W

   C. 50 W

   D. 500 W

55. What is the correct order of energy transformations in a coal power station? *[1 mark]*

   A. thermal → chemical → kinetic → electrical

   B. chemical → thermal → kinetic → electrical

   C. chemical → kinetic → thermal → electrical

   D. kinetic → chemical → electrical → thermal

56. A black body of surface 1.0m^2 emits electromagnetic radiation of peak wavelength 2.90×10^{-6}m. Which of the following statements about the body are correct? *[1 mark]*

   I.   The temperature of the body is 1000 K.
   II. The energy radiated by the body in one second is 5.7×10^4 J.
   III. The body is a perfect absorber of electromagnetic radiation.

   A. I and II only

   B. I and III only

   C. II and III only

   D. I, II and III

57. A negative charge moves in an electric field. Equipotential lines for the field and four possible paths of the charge are shown. Which path corresponds to the largest work done on the charge by the field? *[1 mark]*
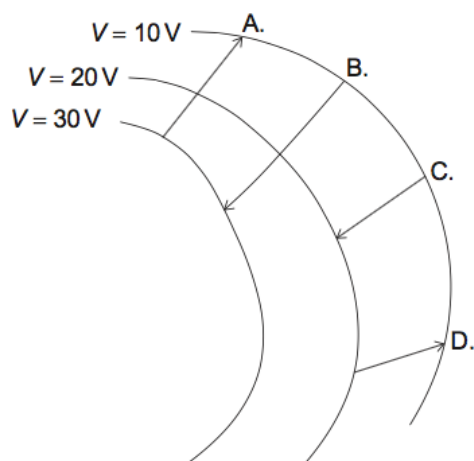
58. In an experiment, oil droplets of mass m and charge q are dropped into the region [1 mark] between two horizontal parallel plates. The electric field E between the plates can be adjusted. Air resistance is negligible. Which is correct when the droplets fall vertically at constant velocity?

A. $E=0$

B. $E < \frac{mg}{q}$

C. $E = \frac{mg}{q}$

D. $E > \frac{mg}{q}$

---

59. A satellite orbits a planet. Which graph shows how the kinetic energy E_K, the potential [1 mark] energy E_P and the total energy E of the satellite vary with distance x from the centre of the planet?

---
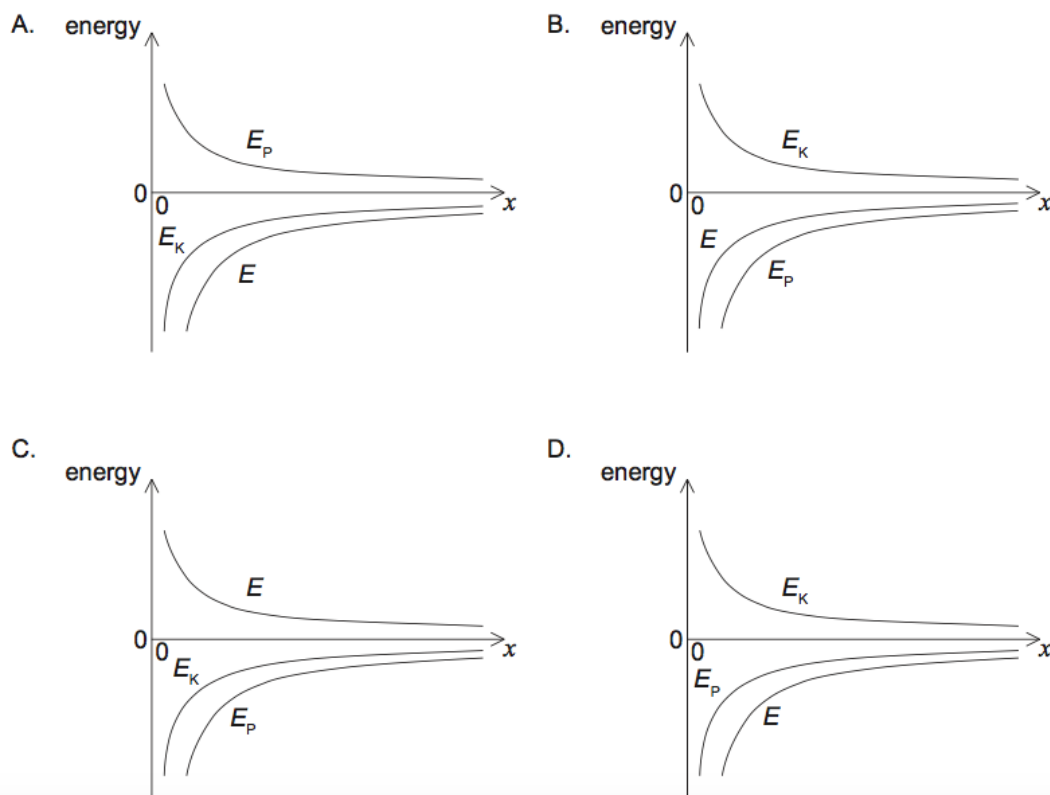
60. Which of the following experiments provides evidence for the existence of matter [1 mark] waves?

A. Scattering of alpha particles

B. Electron diffraction

C. Gamma decay

D. Photoelectric effect

61. It is suggested that the solar power incident at a point on the Earth's surface depends on   *[1 mark]*

   I.   daily variations in the Sun's power output

   II.   the location of the point

   III.   the cloud cover at the point.

   Which suggestion(s) is/are correct?

   A.   III only

   B.   I and II only

   C.   II and III only

   D.   I, II and III

62. The average surface temperature of Mars is about 200 K. The average surface temperature of Earth is about 300 K. Both can be regarded as black bodies.   *[1 mark]*

   What is the ratio $\dfrac{\text{energy radiated per second per unit area on Mars}}{\text{energy radiated per second per unit area on Earth}}$?

   A.   0.7

   B.   0.4

   C.   0.3

   D.   0.2

63. A negatively charged particle falls vertically into a region where there is an electric field. *[1 mark]* The equipotentials of this field are shown.
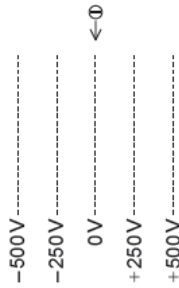
What is the path followed by the particle?
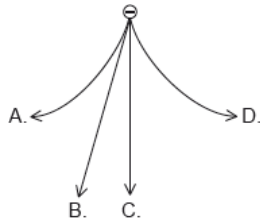
64. An electric dipole consists of a positive and a negative charge separated by a fixed   *[1 mark]*
distance. The electric field due to the dipole is shown in the diagram below.

An electric force acts on an electron at point P. In which direction does this force act?
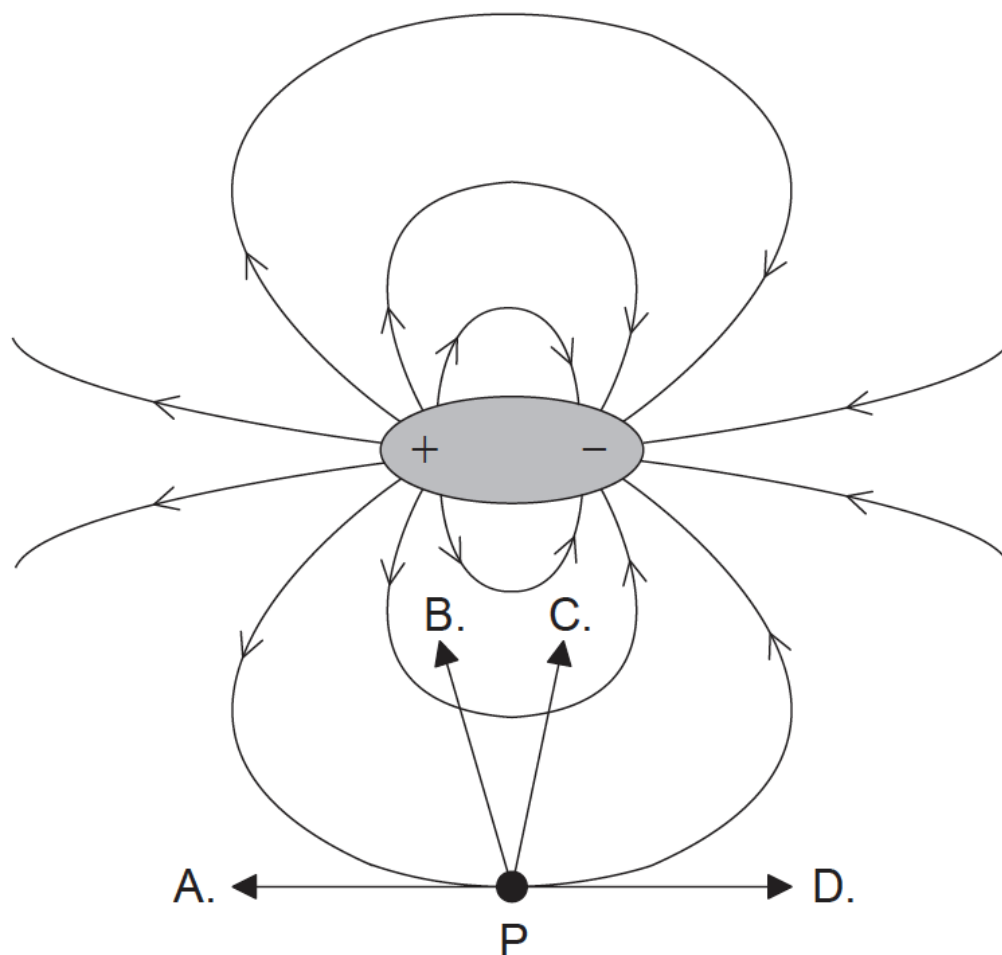
65. A particle has charge and mass. Which types of field cause a force to be exerted on the *[1 mark]*
particle when it is moving in the direction of the field?

A. Electric, gravitational and magnetic fields

B. Electric and magnetic fields only

C. Gravitational and magnetic fields only

D. Electric and gravitational fields only

66. In nuclear power production, what is one advantage of a nuclear fusion reactor over a   *[1 mark]*
nuclear fission reactor?

A. The operating temperature of the fusion reactor is lower.

B. The nuclear reactants are more easily confined within the core of the fusion reactor.

C. The disposal of the nuclear waste products from the fusion reactor is more straightforward.

D. The nuclear fusion reaction is more easily sustained for long periods of time.

67. The Earth rotates about an axis XY, as shown below. *[1 mark]*
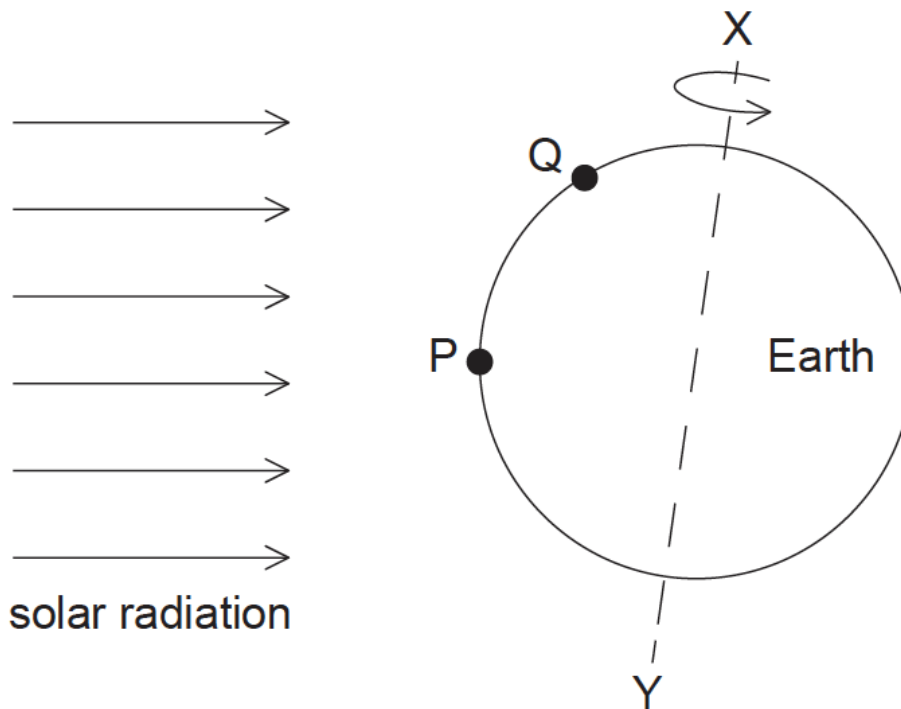
P and Q are positions on the Earth's surface that receive solar radiation from the Sun. Why is the intensity of the solar radiation incident at P significantly greater than the intensity at Q?

A. The same amount of solar power is spread over a larger surface area at P.

B. The path length through the Earth's atmosphere of the solar radiation is shorter for P.

C. The distance travelled by the solar radiation to reach the top of the Earth's atmosphere is shorter for P.

D. The periodic variations in the solar power radiated from the Sun's surface have more effect at P.

68. Which type of power-production system is most suitable for responding to a sudden high increase in demand for electrical power? *[1 mark]*

A. A wind generator

B. A tidal water storage hydroelectric scheme

C. An ocean-wave energy converter

D. A pump storage hydroelectric scheme

69. An electron is held close to the surface of a negatively charged sphere and then released. Which describes the velocity and the acceleration of the electron after it is released?   *[1 mark]*

	Velocity	Acceleration
A.	decreasing	constant
B.	decreasing	decreasing
C.	increasing	constant
D.	increasing	decreasing

70. What is the purpose of the moderator in a nuclear power station?   *[1 mark]*

A. To absorb fast moving neutrons

B. To slow down fast moving neutrons

C. To initiate a chain reaction

D. To transfer the heat generated to a heat exchanger

71. Methane and carbon dioxide are both greenhouse gases that are believed to cause global warming. The reason for this is that these gases   *[1 mark]*

A. absorb incoming radiation from the Sun.

B. transmit the incoming radiation from the Sun and radiation from the Earth.

C. reflect incoming radiation from the Sun.

D. transmit incoming radiation from the Sun and absorb outgoing radiation from the Earth.

72. An electric motor is used to lift a heavy load. The Sankey diagram shows the energy *[1 mark]*
transformations involved in the process.
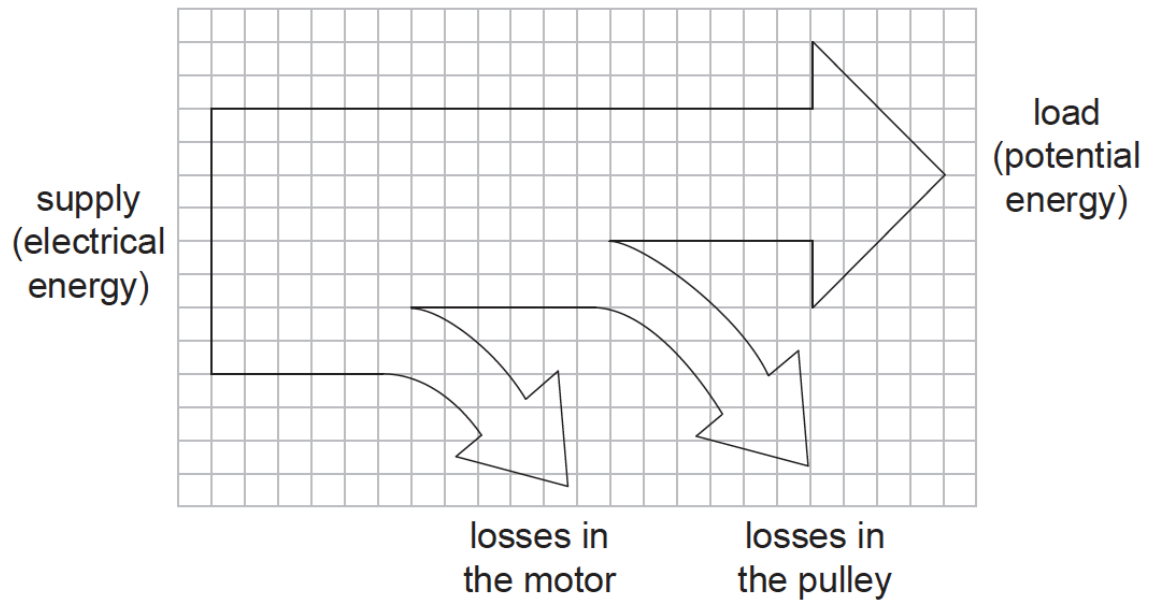
What is the efficiency of the motor?

A. 33%

B. 50%

C. 67%

D. 75%

73. A particle of charge q is at point S in a uniform electric field of strength E. The particle moves a distance w parallel to the field lines and then a distance y perpendicular to the field lines to reach point T. *[1 mark]*
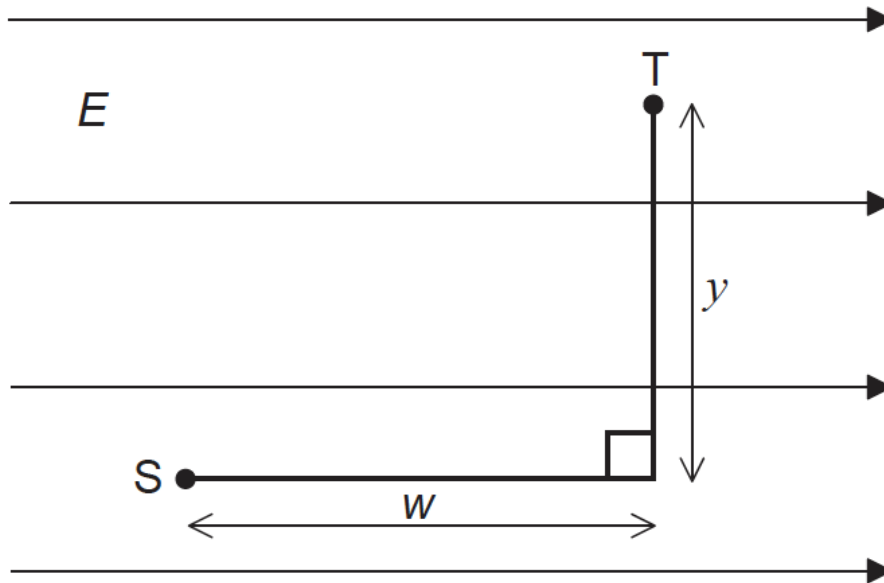
What is the change in electric potential energy of the charge between S and T?

A. Eqw

B. Eqy

C. $Eq(y + w)$

D. $Eq\sqrt{y^2 + w^2}$

74. The diagram shows two point charges P and Q. At which position is the electric field strength equal to zero? *[1 mark]*
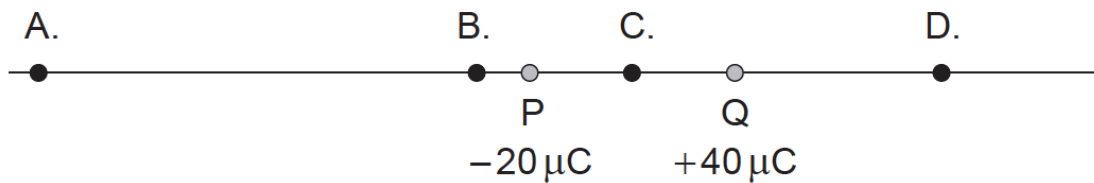
75. An electron is held close to the surface of a negatively charged sphere and then released. Which describes the velocity and the acceleration of the electron after it is released? *[1 mark]*

	Velocity	Acceleration
A.	decreasing	constant
B.	decreasing	decreasing
C.	increasing	constant
D.	increasing	decreasing

76. Two spherical objects of mass M are held a small distance apart. The radius of each object is r. *[1 mark]*
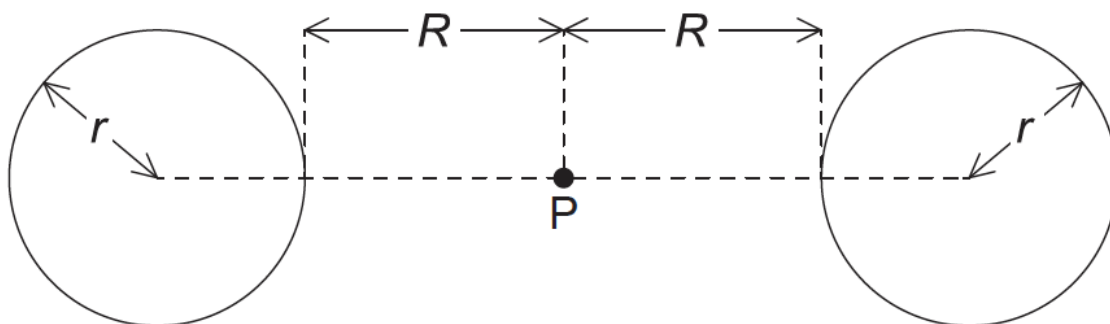
Point P is the midpoint between the objects and is a distance R from the surface of each object. What is the gravitational potential at point P?

A. $-\dfrac{GM}{(r+R)^2}$

B. $-2\dfrac{GM}{r+R}$

C. $-\dfrac{GM}{r+R}$

D. 0

77. The diagram shows equipotential lines around two sources. *[1 mark]*
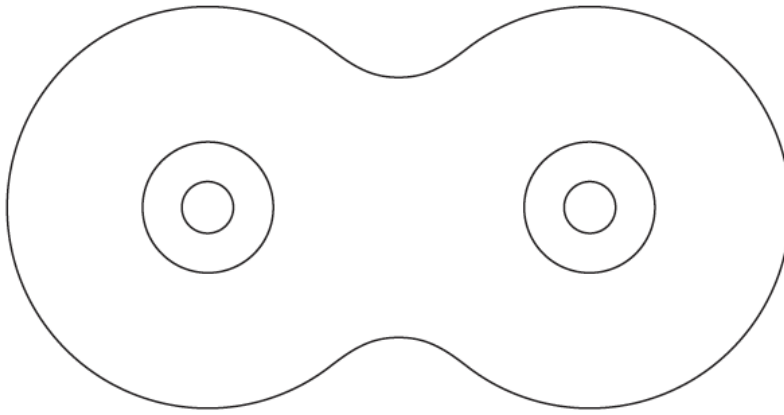
Possible sources are

I. two equal masses

II. two equal charges of same sign

III. two equal charges of opposite sign.

What is/are the possible source(s) for the equipotential lines?

A. I and II only

B. I and III only

C. II only

D. III only

78. The graph shows the variation with wavelength of intensity of radiation emitted by two   *[1 mark]*
   bodies X and Y. X and Y have the same surface area.
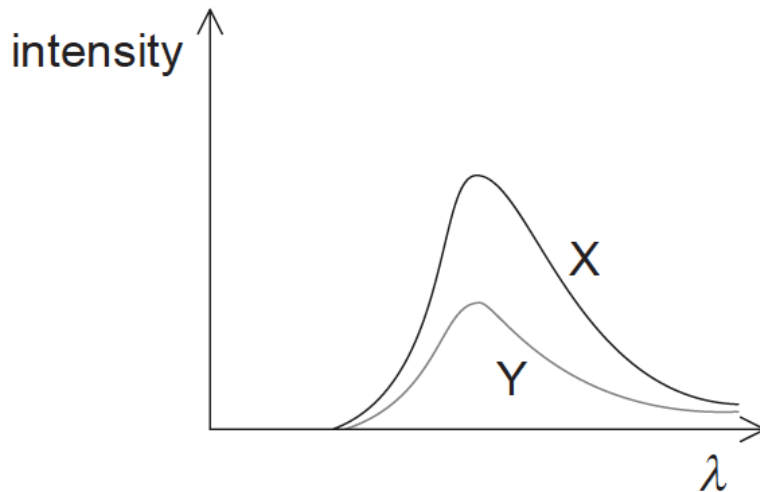
How do the temperature and the emissivity of X compare with the temperature and the emissivity of Y?

	Temperature	Emissivity
A.	different	different
B.	equal	different
C.	different	equal
D.	equal	equal

79. Methane and carbon dioxide are both greenhouse gases that are believed to cause   *[1 mark]*
    global warming. The reason for this is that these gases

A. absorb incoming radiation from the Sun.

B. transmit the incoming radiation from the Sun and radiation from the Earth.

C. reflect incoming radiation from the Sun.

D. transmit incoming radiation from the Sun and absorb outgoing radiation from the Earth.

80. A positive point charge P and a negative point charge Q of equal magnitude are held at *[1 mark]* fixed positions. Y is midway between P and Q.
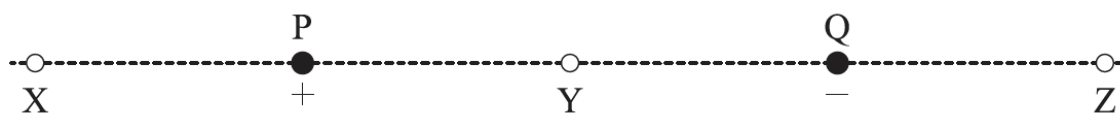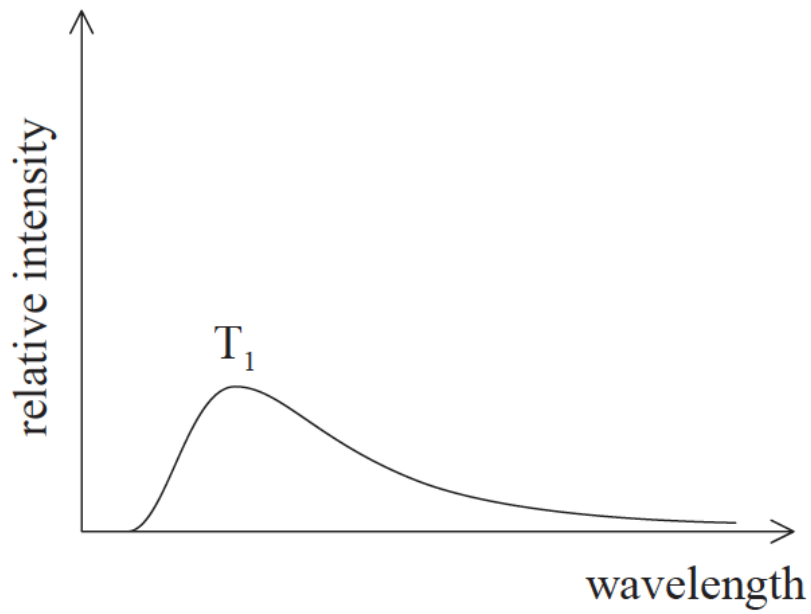

Which of the following gives the direction of the electric field due to the charges at X, Y and Z?

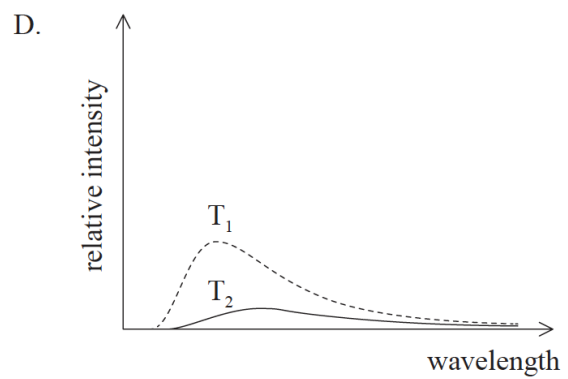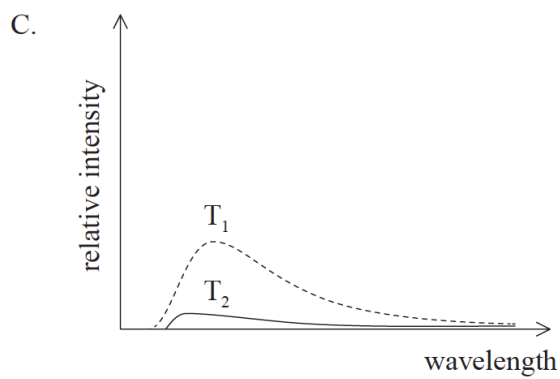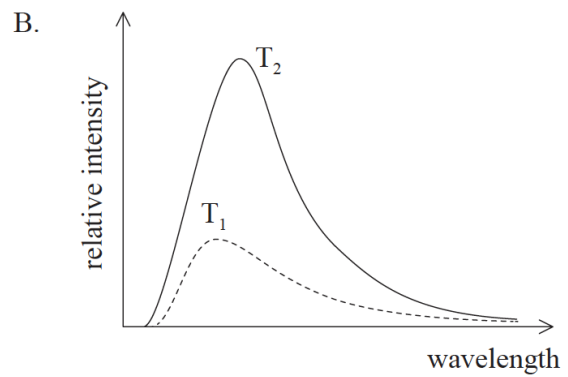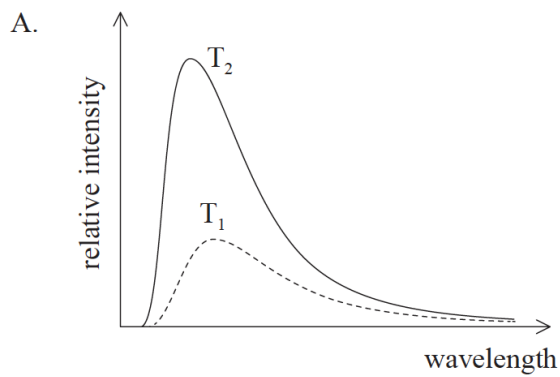|	**X**	**Y**	**Z**
A.	to right	to left	to right
B.	to right	to right	to left
C.	to left	to right	to right
D.	to left	to right	to left

81. What field pattern can be produced by two point charges? *[1 mark]*

A.

B.

C.

D.
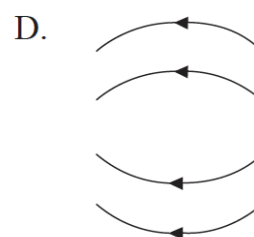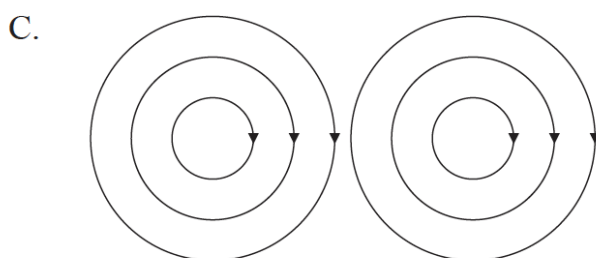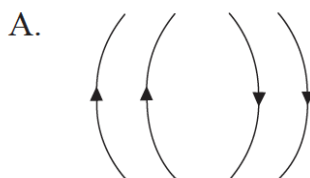
82. The graph shows the emission spectrum for a black body at absolute temperature T_1. *[1 mark]*

Which graph shows the emission spectrum for the same black body at an absolute temperature T_2 where $T_2 > T_1$? The original graph is shown as a dotted line.

A.

B.

C.

D.

83. A positive point charge P and a negative point charge Q of equal magnitude are held at *[1 mark]* fixed positions. Y is a point midway between P and Q.
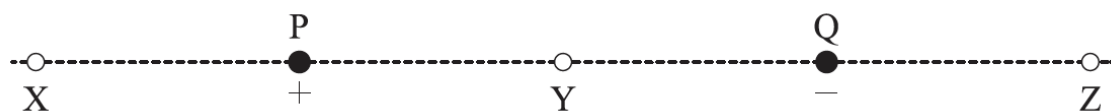
$$\text{X} \quad\quad\quad \underset{+}{\overset{P}{\bullet}} \quad\quad\quad \text{Y} \quad\quad\quad \underset{-}{\overset{Q}{\bullet}} \quad\quad\quad \text{Z}$$

Which of the following gives the direction of the electric field due to the charges at X, Y and Z?

	X	**Y**	**Z**
A.	to right	to left	to right
B.	to right	to right	to left
C.	to left	to right	to right
D.	to left	to right	to left

84. At the surface of a planet of radius r, the gravitational field strength is g and the *[1 mark]* gravitational potential is V. Which gives the gravitational field strength and gravitational potential at a height $3r$ above the surface?

	Gravitational field strength	**Gravitational potential**
A.	$\dfrac{g}{16}$	$\dfrac{V}{4}$
B.	$\dfrac{g}{3}$	$\dfrac{V}{3}$
C.	$\dfrac{g}{4}$	$\dfrac{V}{4}$
D.	$\dfrac{g}{9}$	$\dfrac{V}{3}$

85. A negative ion is held at point P in an electric field as represented by the arrowed field *[1 mark]* lines.
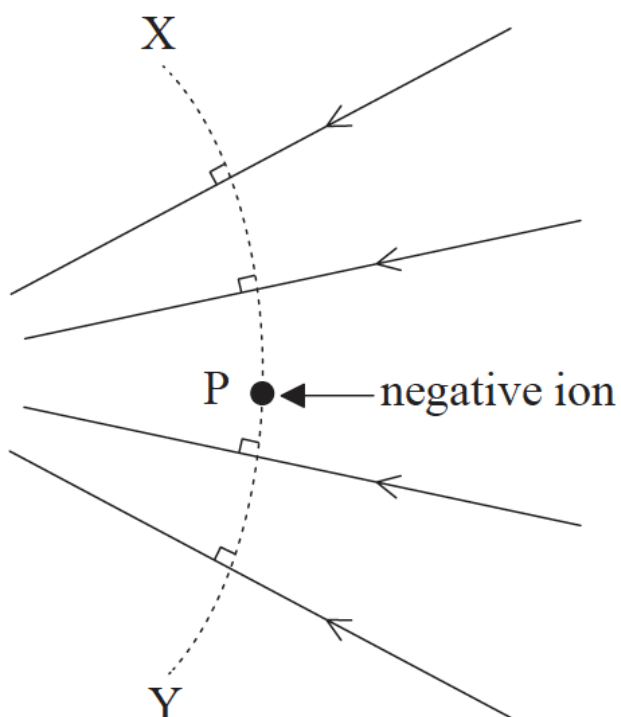
Which of the following describes the effect on the negative ion when it is displaced in a particular direction?

|	Direction of displacement	Effect on the negative ion
A.	to the left	magnitude of electric force on the ion is unchanged
B.	to the right	potential energy of ion increases
C.	along XY towards X	potential energy of ion increases
D.	along XY towards Y	magnitude of electric force on the ion is unchanged

86. Changes in the climate are leading to a reduction in ice cover on Earth. Which of the following describes, for Earth, the change in albedo and the change in the rate of energy absorption? *[1 mark]*

	Change in albedo	Change in rate of energy absorption
A.	decrease	decrease
B.	decrease	increase
C.	increase	increase
D.	increase	decrease

87. The graph shows the emission spectrum for a black body at absolute temperature T_1. *[1 mark]*
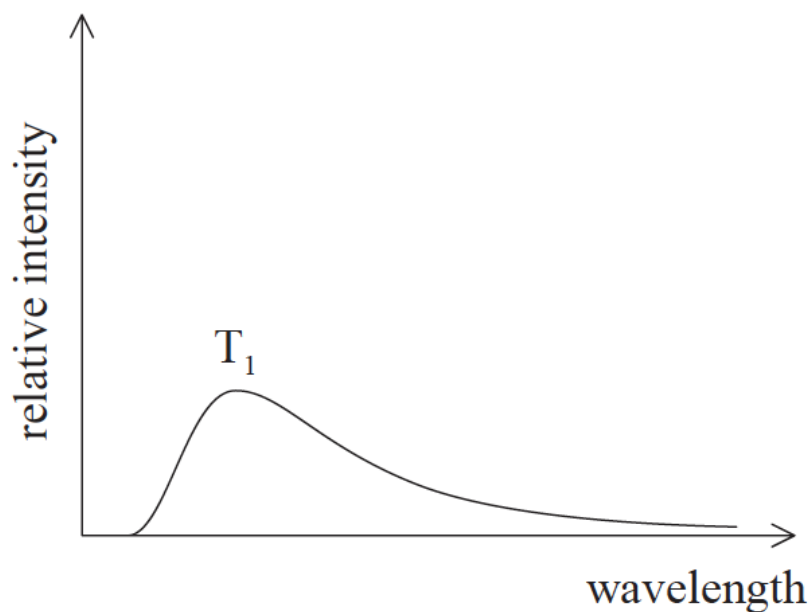
Which graph shows the emission spectrum for the same black body at an absolute temperature T_2 where $T_2 > T_1$? The original graph is shown as a dotted line.
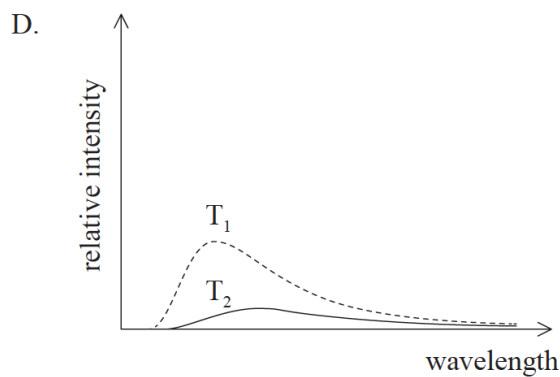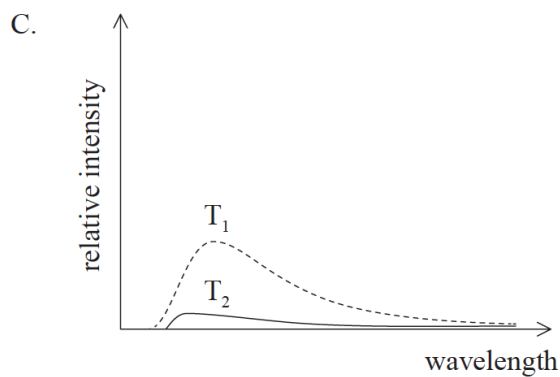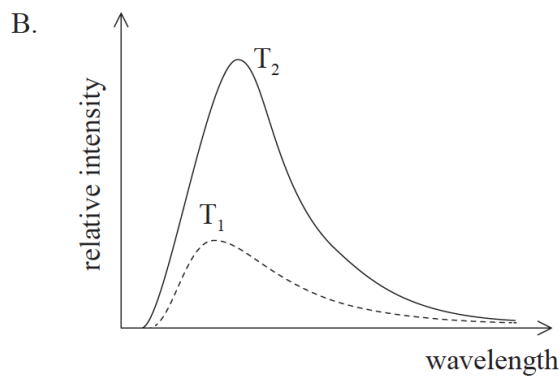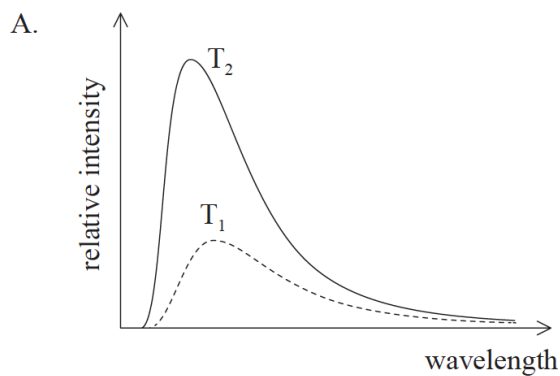
88. A natural gas power station has an output of 600 MW and an efficiency of 50%. The   *[1 mark]*
mass of natural gas that is burned per second is 20kg. What is the energy density of
natural gas?

A. 15 MJkg^{-1}
B. 30 MJkg^{-1}
C. 40 MJkg^{-1}
D. 60 MJkg^{-1}

89. A black body has kelvin temperature T and surface area A. The total power radiated by [1 mark] the body is P. What is the new power radiated when T is doubled and A is halved?

A. $4P$
B. $8P$
C. $16P$
D. $32P$

90. Which of the following best defines non-renewable fuels? [1 mark]

A. They produce a lot of degraded energy in comparison with renewable fuels.
B. They have very high energy density but produce greenhouse gases.
C. They cannot be produced again.
D. Their rate of consumption is much greater than the rate at which they are being produced.

Printed for GEMS INTERNATONAL SCHOOL AL KHAIL