1 Two similar spheres, each of mass m and travelling with speed v, are moving towards each other.

9702/1/M/J/02/Q9

The spheres have a head-on elastic collision.

Which statement is correct?

A The spheres stick together on impact.

B The total kinetic energy after impact is mv^2.

C The total kinetic energy before impact is zero.

D The total momentum before impact is $2mv$.

2 A body, initially at rest, explodes into two masses M_1 and M_2 that move apart with speeds v_1 and v_2 respectively.

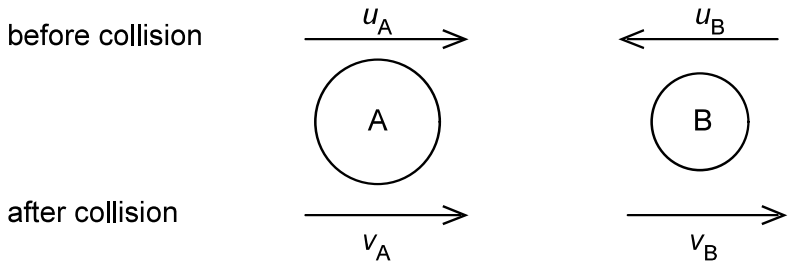
9702/1/M/J/02/Q11

What is the ratio $\frac{v_1}{v_2}$?

A $\frac{M_1}{M_2}$ **B** $\frac{M_2}{M_1}$ **C** $\left(\frac{M_1}{M_2}\right)^{\frac{1}{2}}$ **D** $\left(\frac{M_2}{M_1}\right)^{\frac{1}{2}}$

3 Two spheres A and B approach each other along the same straight line with speeds u_A and u_B. The spheres collide and move off with speeds v_A and v_B, both in the same direction as the initial direction of sphere A, as shown below.

9702/1/O/N/02/Q11



Which equation applies to an elastic collision?

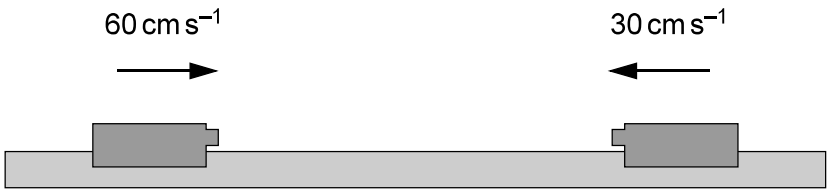
A $u_A + u_B = v_B - v_A$

B $u_A - u_B = v_B - v_A$

C $u_A - u_B = v_B + v_A$

D $u_A + u_B = v_B + v_A$

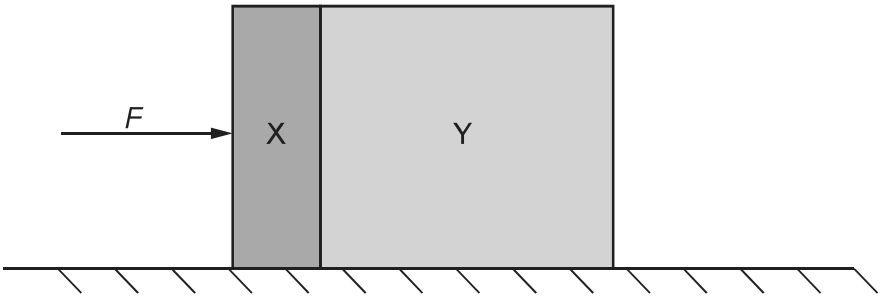
4 Two equal masses travel towards each other on a frictionless air track at speeds of 60 cm s^{-1} and 30 cm s^{-1}. They stick together on impact. 9702/1/O/N/02/Q12



What is the speed of the masses after impact?

A 15 cm s^{-1} **B** 20 cm s^{-1} **C** 30 cm s^{-1} **D** 45 cm s^{-1}

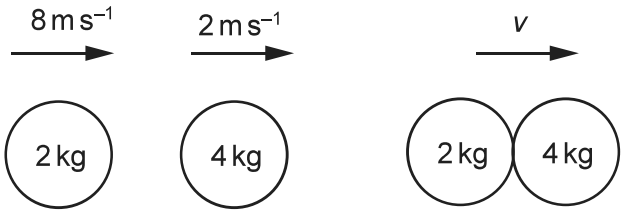
5 Two blocks X and Y, of masses m and $3m$ respectively, are accelerated along a smooth horizontal surface by a force F applied to block X as shown. 9702/01/M/J/03/Q10



What is the magnitude of the force exerted by block X on block Y during this acceleration?

A $\frac{F}{4}$ **B** $\frac{F}{3}$ **C** $\frac{F}{2}$ **D** $\frac{3F}{4}$

6 A ball of mass 2 kg travelling at 8 m s^{-1} strikes a ball of mass 4 kg travelling at 2 m s^{-1}. Both balls are moving along the same straight line as shown. 9702/01/M/J/03/Q12



After collision, both balls move at the same velocity v.

What is the magnitude of the velocity v?

A 4 m s^{-1} **B** 5 m s^{-1} **C** 6 m s^{-1} **D** 8 m s^{-1}

7 A mass accelerates uniformly when the resultant force acting on it 9702/01/O/N/03/Q10

A is zero.

B is constant but not zero.

C increases uniformly with respect to time.

D is proportional to the displacement from a fixed point.

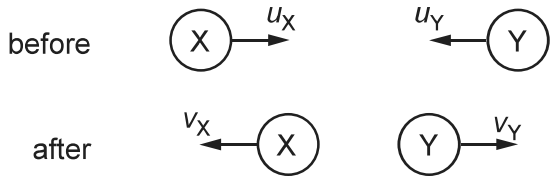
8 A molecule of mass m travelling horizontally with velocity u hits a vertical wall at right angles to the wall. It then rebounds horizontally with the same speed. 9702/01/O/N/03/Q11

What is its change in momentum?

A zero **B** mu **C** $-mu$ **D** $-2mu$

9 Two balls X and Y approach each other along the same straight line and collide elastically.

Their speeds are u_X and u_Y respectively. After the collision they move apart with speeds v_X and v_Y respectively. Their directions are shown on the diagram. 9702/01/O/N/03/Q12



Which of the following equations is correct?

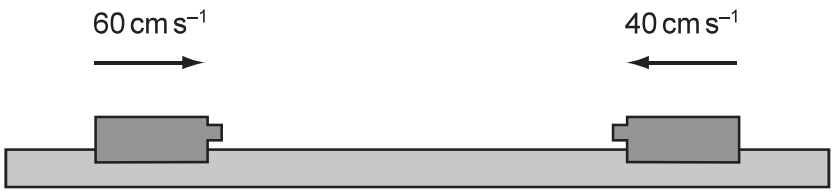
A $u_X + u_Y = v_X + v_Y$

B $u_X + u_Y = v_X - v_Y$

C $u_X - u_Y = v_X + v_Y$

D $u_X - u_Y = v_X - v_Y$

10 **o e ua masses tra e to ar s eac ot er on a riction ess air trac at s ee s o 0 cm s [1] an 40 cm s [1] e stic toget er on im act** **9702 01 0** /Q11



at is t e s ee o t e masses a ter im act

A 10 cm s [1] **B 20 cm s [1]** **C 40 cm s [1]** **D 0 cm s [1]**

11 **A a a s ertica an ounces on t e groun** 9702 01 04/Q10

e o o ing statements are a out t e orces acting i e t e a is in contact it t e groun

ic statement is correct

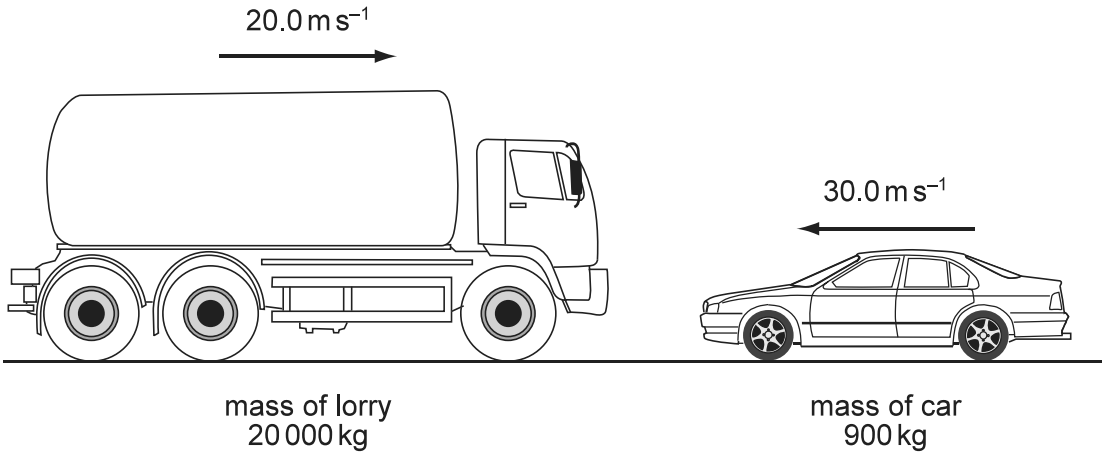
A e orce t att e a e erts on t e groun is a a se ua to t e eig to t e a

B e orce t att e a e erts on t e groun is a a se ua in magnitu e an o osite in irection to t e orce t e groun e erts on t e a

C e orce t att e a e erts on t e groun is a a s ess t an t e eig to t e a

D e eig to t e a is a a se ua in magnitu e an o osite in irection to t e orce t at t e groun e erts on t e a

12 **e iagram s o s a situation ust e ore a ea on co ision A orr o mass 20 000 g is tra e ing at 20 0 m s ^{1} to ar s a car o mass 900 g tra e ing at 0 0 m s ^{1} to ar s t e orr** 9702 01 04/Q11



at is t e magnitu e o t e tota momentum

A 7 s B 427 s C 00 s D 4410 s

13 Which of the following is a statement of the principle of conservation of momentum? 9702/01/O/N/03/Q9

A Momentum is the product of mass and velocity.

B In an elastic collision, momentum is constant.

C The momentum of an isolated system is constant.

D The force acting on a body is proportional to its rate of change of momentum.

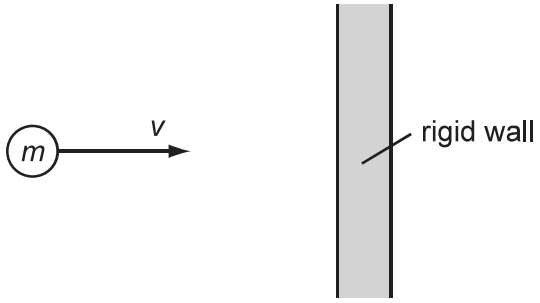
14 **o rai a truc s o masses m an m mo e to ar s eac ot er in o osite irections it s ee s 2 an res ecti e ese truc s co i e an stic toget er** 9702 01 0 /Q12

at is t e s ee o t e truc s a ter t e co ision

A $\frac{}{4}$ **B** $\frac{}{2}$ **C** **D** $\frac{}{4}$

15 A artic e o mass m stri es a ertica rigi a er en icu ar rom t e e t it e ocit

9702 01 04/Q11



t e co ision is er ect e astic t e tota c ange in momentum o t e artic e t at occurs as a resu t o t e co ision is

A 2m to t e rig t

B 2m to t e e t

C m to t e rig t

D m to t e e t

16 ic is not one o e ton s a s o motion 9702 01 0 /Q10

A e tota momentum o a s stem o interacting o ies remains constant ro i ing no e terna orce acts

B e rate o c ange o momentum o a o is irect ro ortiona to t e e terna orce acting on t e o an ta es ace in t e irection o t e orce

C o A e erts a orce on o B t en o B e erts an e ua an o osite irecte orce on o A

D A o continues in a state o rest or o uni orm motion in a straig t ine un ess acte u on some e terna orce

17 A constant mass un ergoes uni orm acce eration 9702 01 04/Q10

ic o t e o o ing is a correct statement a out t e resu tant orce acting on t e mass

A t increases uni orm it res ect to time

B t is constant ut not ero

C t is ro ortiona to t e is acement rom a i e oint

D t is ro ortiona to t e e ocit

18 at is t e centre o gra it o an o ect 9702 01 0 /Q12

A t e geometrica centre o t e o ect

B t e oint a out ic t e tota tor ue is ero

C t e oint at ic t e eig t o t e o ect ma e consi ere to act

D t e oint t roug ic gra it acts

19 ic is a statement o t e rinci e o conser ation o momentum 9702 01 0 /Q9

A A orce is e ua to t e rate o c ange o momentum o t e o u on ic it acts

B n a er ect e astic co ision t e re ati e momentum o t e o ies e ore im act is e ua to t eir re ati e momentum a ter im act

C e momentum o a o is t e ro uct o t e mass o t e o an its e ocit

D e tota momentum o a s stem o interacting o ies remains constant ro i ing no e terna orce acts

20 e gra itationa ie strengt on t e sur ace o anet is one tent o t at on t e sur ace o anet 9702 01 0 /Q10

n t e sur ace o a o as its mass measure to e 1 0 g an its eig t measure to e 1 0

at resu ts are o taine or measurements o t e mass an eig t o t e same o on t e sur ace o anet

	mass on	eig t on
A	1 0 g	0 1
B	1 0 g	10
C	10 g	10
D	10 g	100

21 A c c ist is ri ing at a stea s ee on a e e roa 9702 01 0 /Q10

Accor ing to e ton s t ir a o motion at is e ua an o osite to t e ac ar us o t e ac ee on t e roa

A t e orce e erte t e c c ist on t e e a s

B t e or ar us o t e roa on t e ac ee

C t e tension in t e c c e c ain

D t e tota air resistance an riction orce

22 n er ect e astic co isions et een t o atoms it is a a s true to sa t at 9702 01 0 /Q11

A t e initia s ee o one atom i e t e same as t e ina s ee o t e ot er atom

B t e re ati e s ee o a roac et een t e t o atoms e ua s t eir re ati e s ee o se aration

C t e tota momentum must e conser e ut a sma amount o t e tota inetic energ ma e ost in t e co ision

D ate er t eir initia states o motion neit er atom can e stationar a ter t e co ision

23 A orce is a ie to a ree mo ing o ect At one instant o time t e o ect as e ocit an acce eration a 9702 01 0 /Q10

ic uantities must e in t e same irection

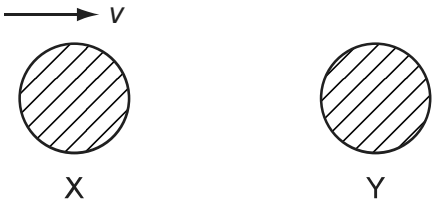
A a an on

B a an on

C an on

D an a

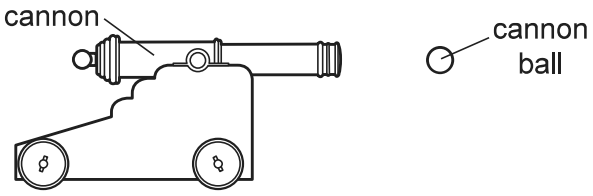
24 e iagram s o s t o i entica s eres an 9702 01 0 /Q11



nitia mo es it s ee irect to ar s is stationar e s eres co i e e astica at a ens

A	mo es it s ee $\frac{1}{2}$ to t e rig t	mo es it s ee $\frac{1}{2}$ to t e rig t
B	mo es it s ee to t e e t	remains stationar
C	mo es it s ee $\frac{1}{2}$ to t e e t	mo es it s ee $\frac{1}{2}$ to t e rig t
D	sto s	mo es it s ee to t e rig t

25 e iagram s o s a cannon a ire rom a cannon 9702 01 0 /Q12



e mass o t e cannon is 1000 g an t e mass o t e cannon a is 10 g

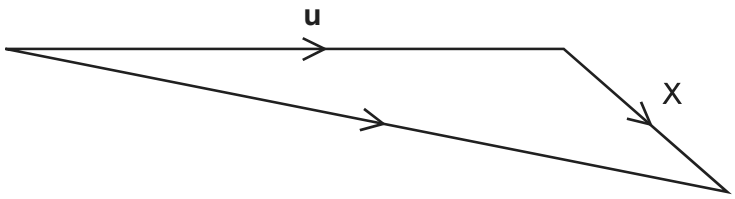
e recoi e ocit o t e cannon is ms ^{1} ori onta

at is t e ori onta e ocit o t e cannon a

A 200 ms ^{1} B 00 ms ^{1} C 2000 ms ^{1} D 000 ms ^{1}

26 An o ect as an initia e ocit u t is su ecte to a constant orce or t secon s causing a constant acce eration a e orce is not in t e same irection as t e initia e ocit 9702 01 07/Q7

A ector iagram is ra n to in t e ina e ocit



at is t e engt o si e o t e ector iagram

A B t C at D u at

27 at is meant t e eig t o an o ect 9702 01 07/Q9

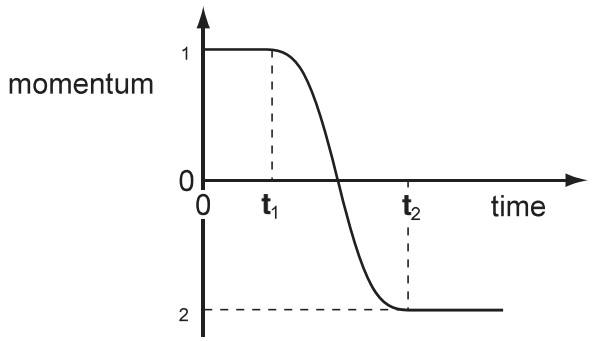
A t e gra itationa ie acting on t e o ect

B t e gra itationa orce acting on t e o ect

C t e mass o t e o ect mu ti ie gra it

D t e o ect s mass mu ti ie its acce eration

28 e gra s o s t e ariation it time o t e momentum o a a as it is ic e in a straig t ine 9702 01 07/Q10



nitia t e momentum is $_1$ at time t_1 At time t_2 t e momentum is $_2$

at is t e magnitu e o t e a erage orce acting on t e a et een times t_1 an t_2

A $\frac{1 \quad 2}{t_2}$ B $\frac{1 \quad 2}{t_2 \quad t_1}$ C $\frac{1 \quad 2}{t_2}$ D $\frac{1 \quad 2}{t_2 \quad t_1}$

29 ic statement a out e ton s a s o motion is correct 9702 01 09/Q7

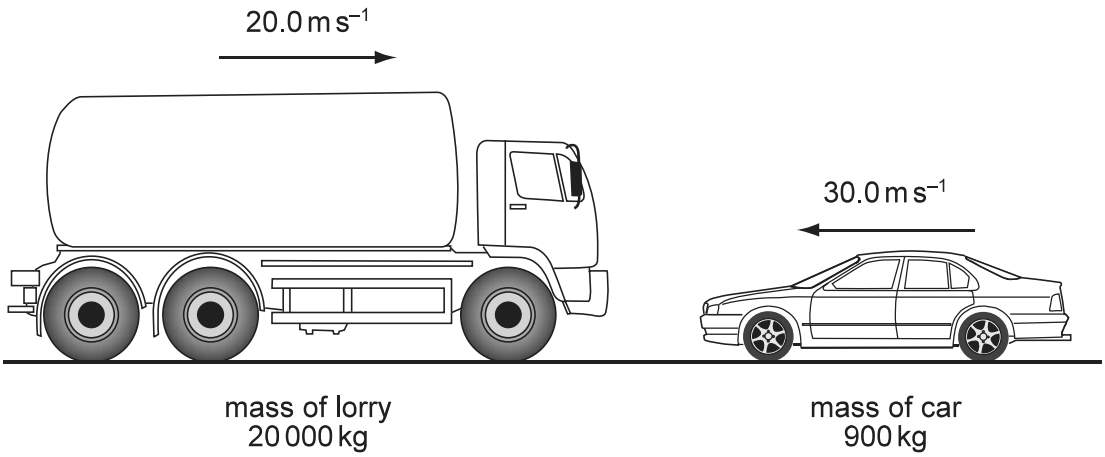
A e irst a o o s rom t e secon a

B e t ir a o o s rom t e secon a

C Conser ation o energ is a conse uence o t e t ir a

D Conser ation o inear momentum is a conse uence o t e irst a

30 **A orr o mass 20 000 g is tra e ing at 20 0 m s 1 A car o mass 900 g is tra e ing at 0 0 m s 1 to ar s t e orr** **9702 01 07**/Q11



at is t e magnitu e o t e tota momentum

A 209 s B 7 s C 427 s D 104 s

31 **e iagram s o s t e masses an e ocities o t o tro e s a out to co i e** **9702 01 07**/Q12

A ter t e im act t e mo e o toget er

at is t e tota inetic energ o t e tro e s a ter t e co ision

A 1 B 12 C 18 D 19

32 **ic is a statement o t e rinci e o conser ation o momentum** **9702 01 08**/Q9

A omentum is t e ro uct o mass an e ocit

B omentum is conser e on in e astic co isions

C omentum is conser e a o ies in a co ision

D omentum is conser e ro i ing no e terna orces act

33 **ic statement a out a a t at stri es a tennis rac et an re oun s is a a s correct** **9702 12 09**/Q7

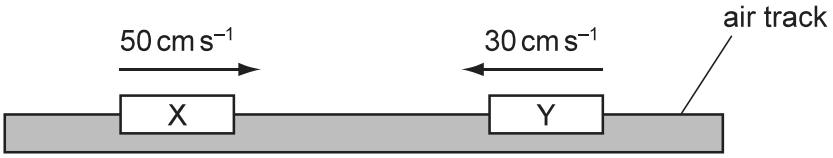
A ota inetic energ o t e a is conser e

B ota inetic energ o t e s stem is conser e

C ota momentum o t e a is conser e

D ota momentum o t e s stem is conser e

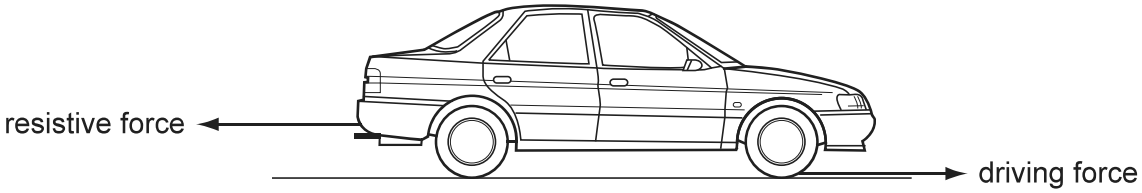
34 o e ua masses an are mo ing to ar s eac ot er on a riction ess air trac as s o n e masses ma e an e astic co ision 9702 01 08/Q10



ic ro gi es ossi e e ocities or t e t o masses a ter t e co ision

	e ocit o	e ocit o
A	ero	20 cms 1 to t e rig t
B	10 cms 1 to t e rig t	10 cms 1 to t e rig t
C	20 cms 1 to t e e t	ero
D	0 cms 1 to t e e t	0 cms 1 to t e rig t

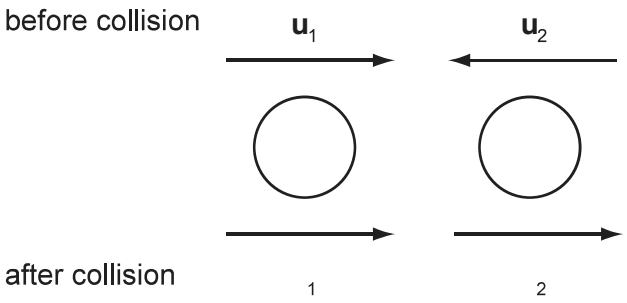
35 A car o mass 7 0 g as a ori onta ri ing orce o 2 0 acting on it t as a or ar ori onta acce eration o 2 0 ms 2 9702 01 08/Q11



at is t e resisti e orce acting ori onta

A 0 B 1 C 2 0 D

36 o s eres a roac eac ot er a ong t e same straig t ine eir s ee s are u_1 an u_2 e ore co ision an $_1$ an $_2$ a ter co ision in t e irections s o n e o 9702/01/O/N/08/Q10



ic e uation is correct i t e co ision is er ect e astic

A u_1 u_2 $_2$ $_1$

B u_1 u_2 $_2$ $_1$

C u_1 u_2 $_2$ $_1$

D u_1 u_2 $_2$ $_1$

37 A a a s ertica an ounces on t e groun 9702 01 08/Q9

e o o ing statements are a out t e orces acting i e t e a is in contact it t e groun

ic statement is correct

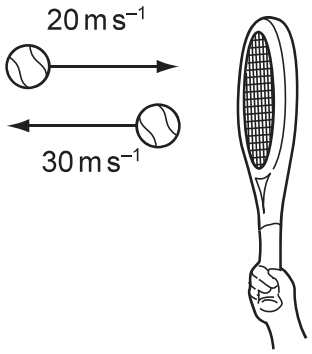
A e orce t att e a e erts on t e groun is a a se ua to t e eig to t e a

B e orce t att e a e erts on t e groun is a a s e ua in magnitu e an o osite in irection to t e orce t e groun e erts on t e a

C e orce t att e a e erts on t e groun is a a s ess t an t e eig to t e a

D e eig to t e a is a a se ua in magnitu e an o osite in irection to t e orce t at t e groun e erts on t e a

38 A tennis a o mass 100 g is struc a tennis rac et e e ocit o t e a is c ange as s o n 9702 01 09/Q9

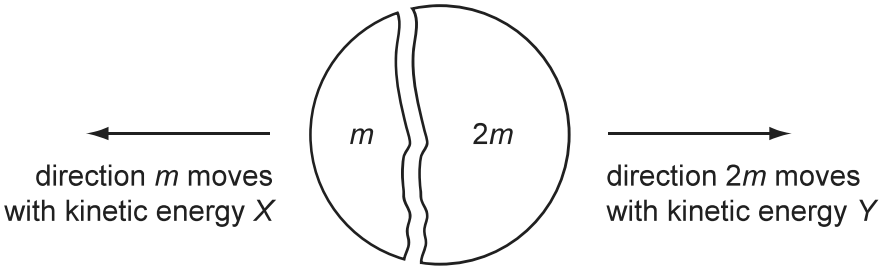


at is t e magnitu e o t e c ange in momentum o t e a

A 1 gms 1 B gms 1 C 1000 gms 1 D 000 gms 1

39 A stationar o e o es into t o com onents o masses m an 2m 9702 01 09/Q10

e com onents gain inetic energies an res ecti e



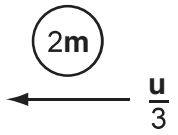
at is t e a ue o t e ratio —

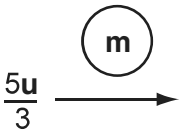
A $\frac{1}{4}$ B $\frac{1}{2}$ C $\frac{2}{1}$ D $\frac{4}{1}$

40 e iagram s o s t o s erica masses a roac ing eac ot er ea on at an e ua s ee u ne as mass 2m an t e ot er as mass m 9702 12 09/Q8

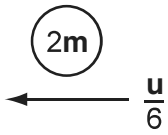
ic iagram s o ing t e situation a ter t e co ision s o s t e resu t o an e astic co ision

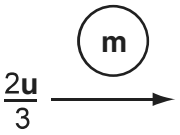
A



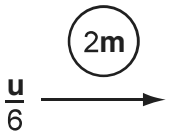


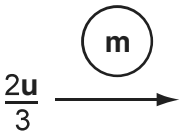
B



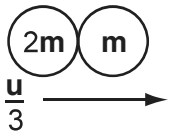


C





D



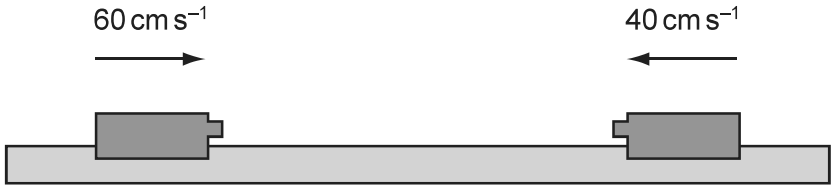
the spheres stick together

41 A su ermar et tro e tota mass 0 g is mo ing at 0 m s ^{1} A retar ing orce o 0 is a ie to t e tro e or 0 0 s in t e o osite irection to t e tro e s initia e ocit 9702 12 09/Q9

at is t e tro e s ne e ocit a ter t e a ication o t e orce

A 1 0 m s ^{1} B 1 m s ^{1} C 2 0 m s ^{1} D 2 8 m s ^{1}

42 o e ua masses tra e to ar s eac ot er on a riction ess air trac at s ee s o 0 cm s ^{1} an 40 cm s ^{1} e stic toget er on im act 9702 11 10/Q10



at is t e s ee o t e masses a ter im act

A 10 cm s ^{1} B 20 cm s ^{1} C 40 cm s ^{1} D 0 cm s ^{1}

43 A o initia at rest e o es into t o masses $_{1}$ an $_{2}$ t at mo e a art it s ee s $_{1}$ an $_{2}$ res ecti e 9702 11 10/Q11

at is t e ratio $\frac{1}{2}$

A $\frac{1}{2}$ B $\frac{2}{1}$ C $\sqrt{\frac{1}{2}}$ D $\sqrt{\frac{2}{1}}$

44 e iagram s o s t o i entica s eres an 9702 11 10/Q12

nitia mo es it s ee irect to ar s is stationar e s eres co i e e astica at a ens

A	mo es it s ee $\frac{1}{2}$ to t e rig t	mo es it s ee $\frac{1}{2}$ to t e rig t
B	mo es it s ee to t e e t	remains stationar
C	mo es it s ee $\frac{1}{2}$ to t e e t	mo es it s ee $\frac{1}{2}$ to t e rig t
D	sto s	mo es it s ee to t e rig t

45 e iagram s o s t o i entica s eres an 9702 1 10/Q9

nitia mo es it s ee irect to ar s is stationar e s eres co i e e astica at a ens

A	mo es it s ee $\frac{1}{2}$ to t e rig t	mo es it s ee $\frac{1}{2}$ to t e rig t
B	mo es it s ee to t e e t	remains stationar
C	mo es it s ee $\frac{1}{2}$ to t e e t	mo es it s ee $\frac{1}{2}$ to t e rig t
D	sto s	mo es it s ee to t e rig t

46 ic e ines t e eig to a o 9702 12 10/Q10

A t e amount o matter in t e o

B t e orce o gra it on t e o

C t e num er o artic es in t e o

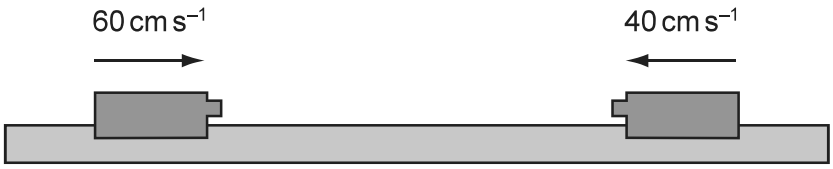
D t e ro uct o t e o s oume an ensit

47 e iagram s o s t o i entica s eres an 9702 12 10/Q10

nitia mo es it s ee irect to ar s is stationar e s eres co i e e astica at a ens

A	mo es it s ee $\frac{1}{2}$ to t e rig t	mo es it s ee $\frac{1}{2}$ to t e rig t
B	mo es it s ee to t e e t	remains stationar
C	mo es it s ee $\frac{1}{2}$ to t e e t	mo es it s ee $\frac{1}{2}$ to t e rig t
D	sto s	mo es it s ee to t e rig t

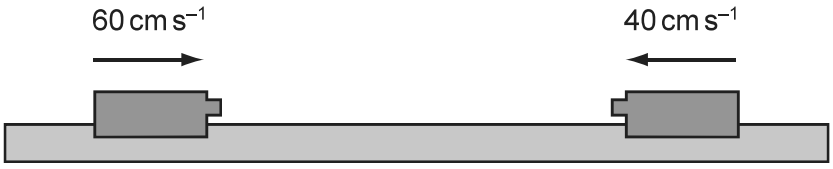
48 o e ua masses tra e to ar s eac ot er on a riction ess air trac at s ee s o 0cms^{1} an 40cms^{1} e stic toget er on im act 9702 12 10/Q11



at is t e s ee o t e masses a ter im act

A 10cms^{1} B 20cms^{1} C 40cms^{1} D 0cms^{1}

49 o e ua masses tra e to ar s eac ot er on a riction ess air trac at s ee s o 0cms^{1} an 40cms^{1} e stic toget er on im act 9702 1 10/Q12



at is t e s ee o t e masses a ter im act

A 10cms^{1} B 20cms^{1} C 40cms^{1} D 0cms^{1}

50 A mo ecu e o mass m tra e ing ori onta it e ocit u its a ertica a at rig t ang es to its e ocit t t en re oun s ori onta it t e same s ee 9702 11 11/Q10

at is its c ange in momentum

A ero B mu C mu D 2mu

51 e gra itationa ie strengt on t e sur ace o anet is one tent o t at on t e sur ace o anet 9702 11 10/Q10

n t e sur ace o a o as a mass o 1 0 g an a eig t o 1 0

at are t e mass an eig t o t e same o on t e sur ace o anet

	mass on g	eig t on
A	1 0	0 1
B	1 0	10
C	10	10
D	10	100

52 o e eriments are carrie out using t o tro e s o e ua mass A mo ing arts o t e tro e s are riction ess as is t e sur ace t at t e tro e s mo e o er n ot e eriments tro e mo es to ar s tro e ic is initia stationar 9702 11 10/Q12

A ter t e co ision in e eriment 1 is stationar an mo es o to t e rig t

A ter t e co ision in e eriment 2 t e tro e s oin an mo e o toget er

at t es o co ision occur in t ese e eriments

	e eriment 1	e eriment 2
A	e astic	e astic
B	e astic	ine astic
C	ine astic	e astic
D	ine astic	ine astic

53 A o initia at rest e o es into t o masses $_1$ an $_2$ t at mo e a art it s ee s $_1$ an $_2$ res ecti e 9702/13/O/N/10/Q9

at is t e ratio $\frac{_1}{_2}$

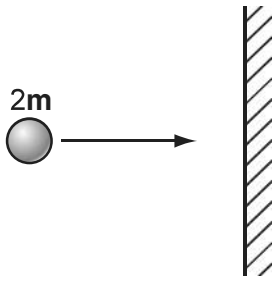
A $\frac{_1}{_2}$ B $\frac{_2}{_1}$ C $\sqrt{\frac{_1}{_2}}$ D $\sqrt{\frac{_2}{_1}}$

54 e momentum o an o ect c anges rom 1 0 gms^{-1} to 240 gms^{-1} in 2 s 9702 12 11/Q11

at is t e mean resu tant orce on t e o ect uring t e c ange

A 40 B 80 C 200 D 400

55 A artic e o mass 2m an e ocit stri es a a 9702 12 10/Q9



e artic e re oun s a ong t e same at a ter co i ing it t e a e co ision is ine astic

at is a ossi e c ange in t e momentum o t e a uring t e co ision

A m B 2m C m D 4m

56 e gra itationa ie strengt on t e sur ace o anet is one tent o t at on t e sur ace o anet 9702 1 10/Q8

n t e sur ace o a o as a mass o 1 0 g an a eig t o 1 0

at are t e mass an eig t o t e same o on t e sur ace o anet

	mass on g	eig t on
A	1 0	0 1
B	1 0	10
C	10	10
D	10	100

57 o e eriments are carrie out using t o tro e s o e ua mass A mo ing arts o t e tro e s are riction ess as is t e sur ace t at t e tro e s mo e o er n ot e eriments tro e mo es to ar s tro e ic is initia stationar 9702 1 10/Q10

A ter t e co ision in e eriment 1 is stationar an mo es o to t e rig t

A ter t e co ision in e eriment 2 t e tro e s oin an mo e o toget er

at t es o co ision occur in t ese e eriments

	e eriment 1	e eriment 2
A	e astic	e astic
B	e astic	ine astic
C	ine astic	e astic
D	ine astic	ine astic

58 A o as a eig t o 8 9 en on t e art n t e oon t e acce eration o ree a is 1 4 ms ^{2} 9702 11 11/Q8

at are t e eig t an t e mass o t e o en it is on t e oon

	eig t	mass g
A	9 8	1 00
B	9 8	00
C	8 9	1 00
D	8 9	00

59 A o o mass m mo ing at e ocit co i es it a stationar o o t e same mass an stic s to it 9702 11 11/Q9

ic ro escri es t e momentum an inetic energ o t e t o o ies a ter t e co ision

	momentum	inetic energ
A	m	$\frac{1}{4}$ m ^{2}
B	m	$\frac{1}{8}$ m ^{2}
C	2m	$\frac{1}{2}$ m ^{2}
D	2m	m ^{2}

60 A orce is a ie to a ree mo ing o ect At one instant o time t e o ect as e ocit an acce eration a 9702 12 11/Q10

ic uantities must e in t e same irection

A a an on

B a an on

C an on

D an a

61 A car acce erates in a straig t ine 9702 12 11/Q12

A gra o t e momentum o t e car is otte against time

at is e a uate in ing t e gra ient o t e gra at a articu ar time

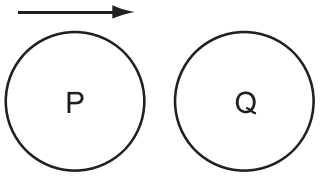
A t e acce eration o t e car

B t e resu tant orce on t e car

C t e inetic energ o t e car

D t e o er su ie to t e car

62 e iagram s o s a artic e tra e ing at s ee a out to co i e it a stationar artic e o t e same mass e co ision is er ect e astic 9702 12 11/Q13



ic statement escri es t e motion o an o imme iate a ter t e co ision

A re oun s it s ee $\frac{1}{2}$ an ac uires s ee $\frac{1}{2}$

B re oun s it s ee an remains stationar

C an ot tra e in t e same irection it s ee $\frac{1}{2}$

D comes to a stan sti an ac uires s ee

63 A mo ecu e o mass m tra e ing ori onta it e ocit u its a ertica a at rig t ang es to its e ocit t t en re oun s ori onta it t e same s ee 9702 1 11/Q9

at is its c ange in momentum

A ero B mu C mu D 2mu

64 A o o mass m mo ing at e ocit co i es it a stationar o o t e same mass an stic s to it

ic ro escri es t e momentum an inetic energ o t e t o o ies a ter t e co ision 9702 1 11/Q10

	momentum	inetic energ
A	m	$\frac{1}{4}m^{2}$
B	m	$\frac{1}{8}m^{2}$
C	2m	$\frac{1}{2}m^{2}$
D	2m	m^{2}

65 A o as a eig t o 8 9 en on t e art n t e oon t e acce eration o ree a is 1 4 ms^{2} 9702 1 11/Q6

at are t e eig t an t e mass o t e o en it is on t e oon

	eig t	mass g
A	9 8	1 00
B	9 8	00
C	8 9	1 00
D	8 9	00

66 at is t e e inition o t e orce on a o 9702 11 11/Q10

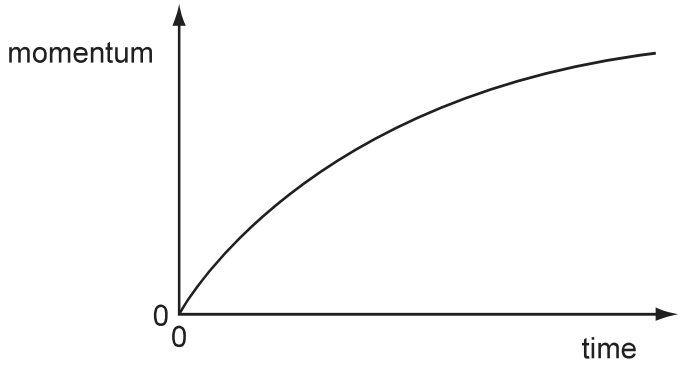
A t e mass o t e o mu ti ie its acce eration

B t e o er in ut to t e o i i e its e ocit

C t e rate o c ange o momentum o t e o

D t e or one on t e o i i e its is acement

67 A car acce erates rom rest e gra s o s t e momentum o t e car otte against time 9702 11 11/Q11



at is t e meaning o t e gra ient o t e gra at a articu ar time

A t e resu tant orce on t e car

B t e e ocit o t e car

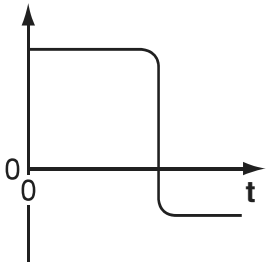
C t e inetic energ o t e car

D t e rate o c ange o inetic energ o t e car

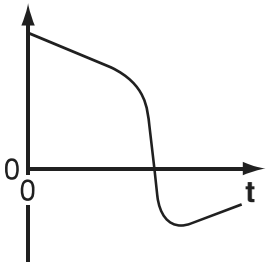
68 An ice oc e uc s i es a ong a ori onta riction ess ice rin sur ace t co i es ine astica it a a at rig t ang es to its at an t en re oun s a ong its origina at 9702 11 11/Q12

ic gra s o s t e ariation it time t o t e momentum o t e uc

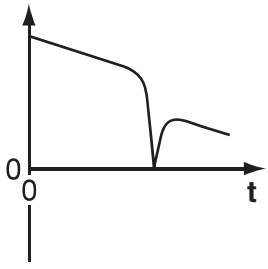
A



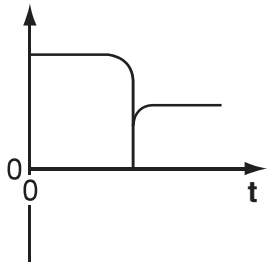
B



C



D



69 An o ect o mass 20 g is tra e ing at a constant s ee o 0 ms ^{1} 9702 12 11/Q11

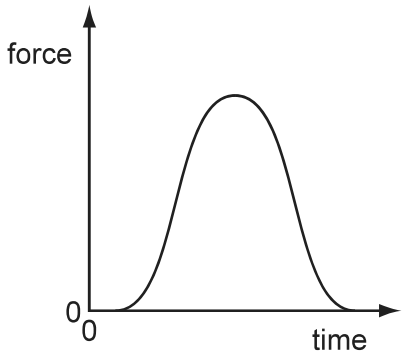
t co i es it an o ect o mass 12 g tra e ing at a constant s ee o 1 ms ^{1} in t e o osite irection e o ects stic toget er

at is t e s ee o t e o ects imme iate a ter t e co ision

A 1 9 ms ^{1} B 9 0 ms ^{1} C 9 4 ms ^{1} D 21 ms ^{1}

70 A go a is it a cu e gra s o s t e ariation it time o t e orce e erte on t e a t e cu

9702 12 11/Q9



ic uantit or t e time o contact cannot e oun rom t e gra

A t e a erage orce on t e a

B t e c ange in momentum o t e a

C t e contact time et een t e a an t e cu

D t e ma imum acce eration o t e a

71 A grou o stu ents in estigating t e rinci e o conser ation o momentum use a sma truc tra e ing o er a riction ess sur ace

9702 12 11/Q10

an is ro e into t e truc as it asses At a tra oor in t e ottom o t e truc o ens an t e san a s out

o oes t e e ocit o t e truc c ange en t e san is a e to t e truc at an t en ea es t e truc at

	at	at
A	ecreases	increases
B	ecreases	sta s t e same
C	sta s t e same	increases
D	sta s t e same	sta s t e same

72 at is t e e inition o t e orce on a o

A t e mass o t e o mu ti ie its acce eration

B t e o er in ut to t e o i i e its e ocit

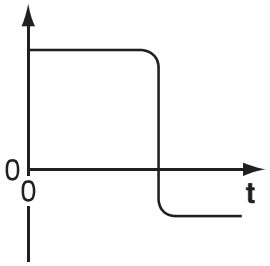
C t e rate o c ange o momentum o t e o

D t e or one on t e o i i e its is acement

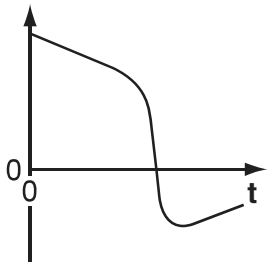
73 An ice oc e uc si es a ong a ori onta riction ess ice rin sur ace t co i es ine astica it a a at rig t ang es to its at an t en re oun s a ong its origina at 9702 1 11/Q10

ic gra s o s t e ariation it time t o t e momentum o t e uc

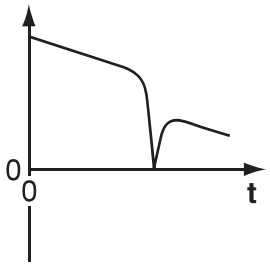
A



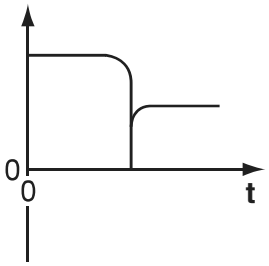
B



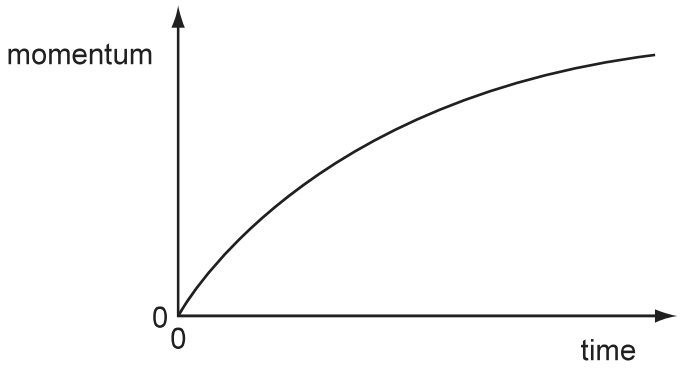
C



D



74 A car acce erates rom rest e gra s o s t e momentum o t e car otte against time 9702 1 11/Q12



at is t e meaning o t e gra ient o t e gra at a articu ar time

A t e resu tant orce on t e car

B t e e ocit o t e car

C t e inetic energ o t e car

D t e rate o c ange o inetic energ o t e car

75 ic ro correct states et er momentum an inetic energ are conser e in an ine astic co ision in ic t ere are no e terna orces 9702 12 12/Q11

	momentum	inetic energ
A	conser e	conser e
B	conser e	not conser e
C	not conser e	conser e
D	not conser e	not conser e

76 o s eres a roac eac ot er a ong t e same straig t ine eir s ee s are u_1 an u_2 e ore co ision A ter t e co ision t e s eres se arate it s ee s $_1$ an $_2$ in t e irections s o n e o 9702 12 12/Q12

ic e uation must e correct i t e co ision is er ect e astic

A u_1 u_2 $_2$ $_1$

B u_1 u_2 $_2$ $_1$

C u_1 u_2 $_2$ $_1$

D u_1 u_2 $_2$ $_1$

77 ac o tion gi es a correct or e uation in o ing orce 9702 12 12/Q10

ic o tion gi es t e e inition o orce

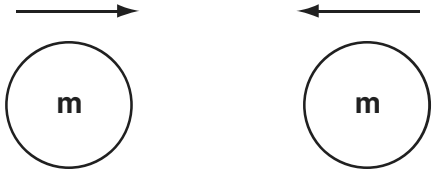
A orce energ i i e is acement

B orce mass acce eration

C orce ressure area

D orce rate o c ange o momentum

78 o simi ar s eres eac o mass m an tra e ing it s ee are mo ing to ar s eac ot er 9702 12 12/Q11



e s eres a e a ea on e astic co ision

ic statement is correct

A e s eres stic toget er on im act

B e tota inetic energ a ter im act is m ^{2}

C e tota inetic energ e ore im act is ero

D e tota momentum e ore im act is 2m

79 ac o tion gi es a correct or e uation in o ing orce 9702 1 12/Q11

ic o tion gi es t e e inition o orce

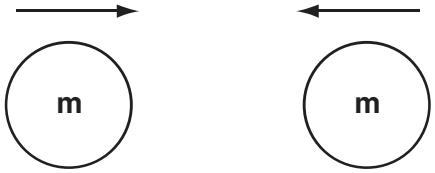
A orce energ i i e is acement

B orce mass acce eration

C orce ressure area

D orce rate o c ange o momentum

80 o simi ar s eres eac o mass m an tra e ing it s ee are mo ing to ar s eac ot er 9702 1 12/Q12



e s eres a e a ea on e astic co ision

ic statement is correct

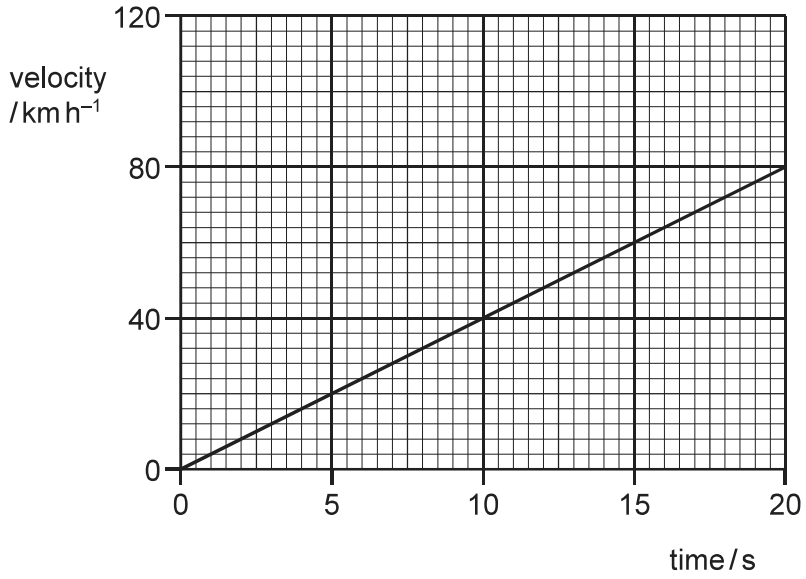
A e s eres stic toget er on im act

B e tota inetic energ a ter im act is m ^{2}

C e tota inetic energ e ore im act is ero

D e tota momentum e ore im act is 2m

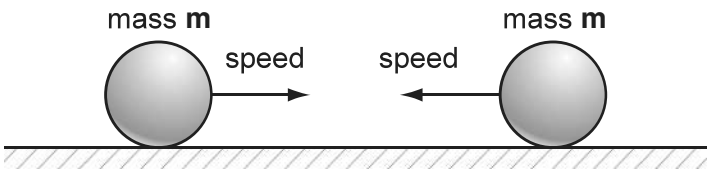
81 e e ocit o a car c anges as s o n 9702 12 12/Q11



at is t e acce eration o t e car

A 1 1ms ^{2} B 4 0ms ^{2} C 224ms ^{2} D 800ms ^{2}

82 o i entica er ect e astic s eres a e t e same mass m e tra e to ar s eac ot er it t e same s ee a ong a ori onta riction ess sur ace 9702 12 12/Q13



ic statement a out t e sum o t e inetic energies o t e s eres is correct

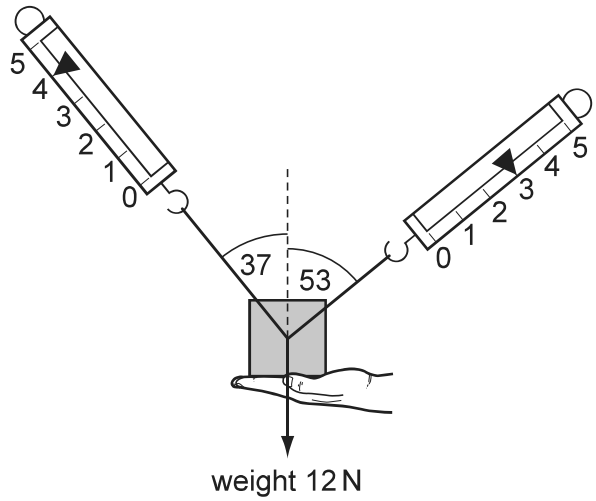
A e sum o t eir inetic energies e ore im act is ero

B e sum o t eir inetic energies e ore im act is $\frac{1}{2}$ m ^{2}

C e sum o t eir inetic energies a ter im act is ero

D e sum o t eir inetic energies a ter im act is m ^{2}

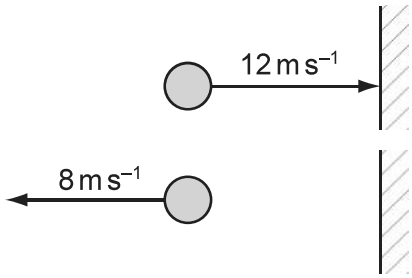
83 A 1 2 g mass is su orte a erson s an an t o ne ton meters as s o n 9702 12 12/Q14



en t e erson s an is remo e at is t e initia ertica acce eration o t e mass

A 0 ms ^{2} B 2 ms ^{2} C 4 ms ^{2} D ms ^{2}

84 A a o mass 0 g is t ro n against a a at a s ee o 12 ms ^{1} t ounces ac it a s ee o 8 ms ^{1} e co ision asts or 0 10 s 9702 12 12/Q12



at is t e a erage orce on t e a ue to t e co ision

A 0 2 B 1 C 20 D 100

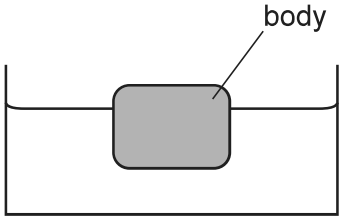
85 A orr o mass 20 000 g as a constant resu tant orce acting on it 9702 12 12/Q15

t acce erates rom 0 m s ^{1} to 0 0 m s ^{1} in a time o 00 s

at is t e c ange in momentum o t e orr an t e a ue o

	c ange in momentum s	orce
A	48 000	1 0
B	480 000	1 00
C	00 000	2000
D	00 000	20 000

86 A stationar o oats in ater 9702 12 12/Q16



ic statement a out t e orces acting on t e o is correct

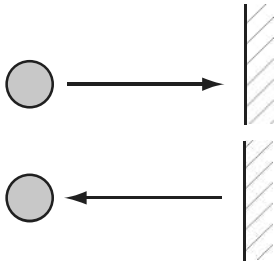
A e gra itationa orce is e ua to t e iscous orce

B e gra itationa orce is greater t an t e u t rust

C e u t rust is ero

D e iscous orce is ero

87 An o ect tra e ing it e ocit stri es a a an re oun s ass o n 9702 11 12/Q11



ic ro ert o t e o ect is not conser e

A inetic energ

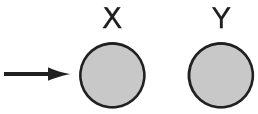
B mass

C momentum

D s ee

88 A artic e as s ee an co i es it a stationar i entica artic e e co ision is er ect e astic

9702 11 12/Q12

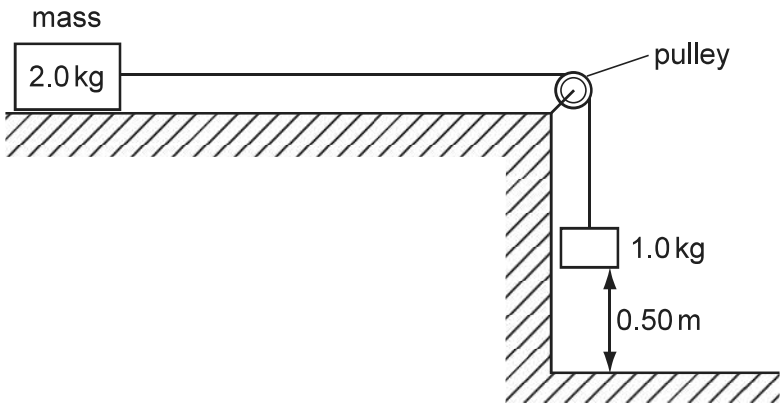


at are t e s ee an irection o motion o eac o t e t o artic es a ter t e co ision

A	stationar	to t e rig t
B	$\frac{}{2}$ to t e rig t	$\frac{}{2}$ to t e rig t
C	$\frac{}{2}$ to t e e t	$\frac{}{2}$ to t e rig t
D	to t e e t	stationar

89 A mass o 2 0 g rests on a riction ess sur ace t is attac e to a 1 0 g mass a ig t t in string ic asses o er a riction ess u e e 1 0 g mass is re ease an it acce erates o n ar s

9702 11 12/Q13

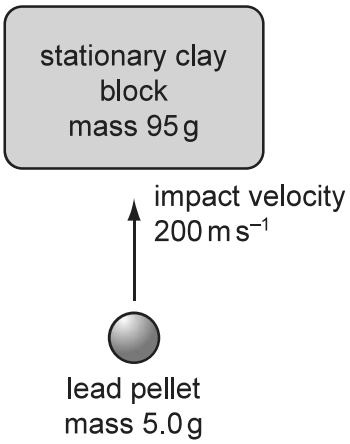


at is t e s ee o t e 2 0 g mass as t e 1 0 g mass its t e oor a ing a en a istance o 0 0m

A 1 8ms^{1} B 2 2ms^{1} C 1ms^{1} D 9 8ms^{1}

90 A ea e et is s ot ertica u ar s into a c a oc t at is stationar at t e moment o im act ut is a e to rise ree a ter im act

9702 11 12/Q14



e e et its t e oc it an initia e ocit o 200 m s 1 t em e s itse in t e oc an oes not emerge

o ig a o e its initia osition i t e oc rise ass o e et 0 g mass o c a oc 9 g

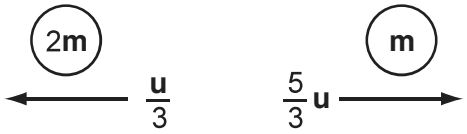
A 1 m B m C 10 m D 2000 m

91 e iagram s o s t o s erica masses a roac ing eac ot er ea on at an e ua s ee u ne is o mass m an t e ot er o mass 2m

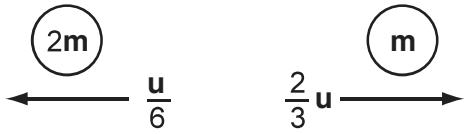
9702 1 12/Q11

ic iagram s o ing t e situation a ter t e co ision is not consistent it t e rinci e o conser ation o momentum

A

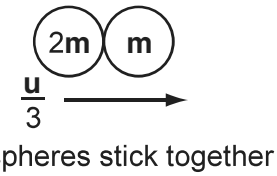


B



C

D



92 A mo ecu e o mass m tra e ing at s ee its a a in a irection er en icu ar to t e a e co ision is e astic 9702 1 12/Q12

at are t e c anges in t e inetic energ an in t e momentum o t e mo ecu e cause t e co ision

	c ange in momentum	c ange in inetic energ
A	0	0
B	0	m^2
C	2m	0
D	m^2	0

93 e A sate ite as mass 20 g an mo es t roug s ace using a so ar sai o area 20 m^2 e a erage so ar in ressure is 1 0 10 m^2 9702 1 12/Q13

at is t e acce eration o t e sate ite cause t e so ar in

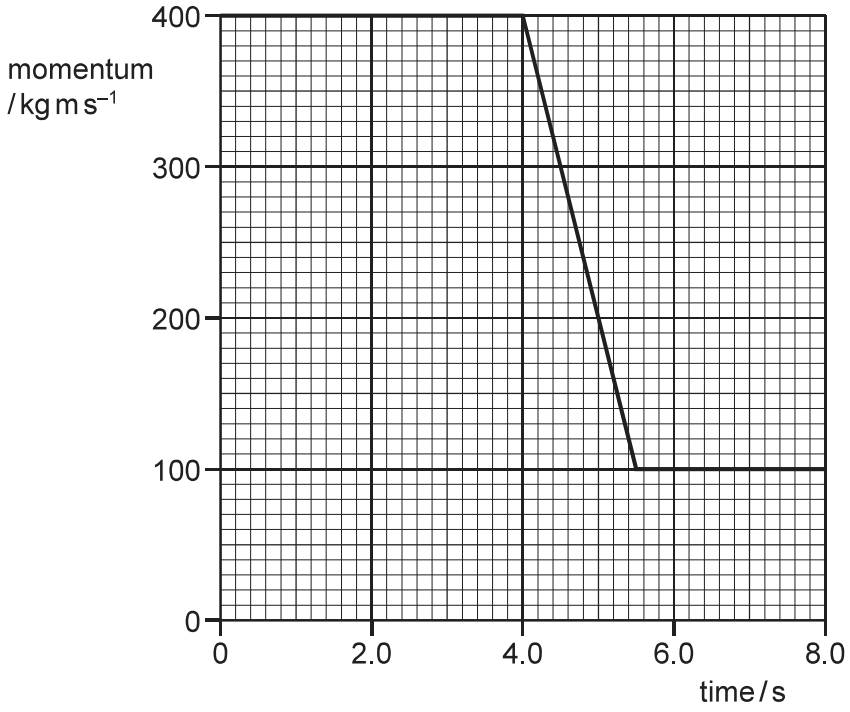
A 1 10^{8} ms^{2}

B 10^{7} ms^{2}

C 2 10 ms^{2}

D 4 10^{2} ms^{2}

94 e gra s o s t e momentum o a c c ist o er a erio o 8 0s 9702 1 12/Q14



At time 4 0s s e a ies t e ra es

at is t e resu tant orce on t e c c ist uring t e erio en t e ra es are a ie

A B 200 C 270 D 4 0

95 ic o t e o o ing is a statement o t e rinci e o conser ation o momentum 9702 11 1 /Q10

A n an e astic co ision momentum is constant

B omentum is t e ro uct o mass an e ocit

C e orce acting on a o is ro ortiona to its rate o c ange o momentum

D e momentum o an iso ate s stem is constant

96 A stationar nuc eus as nuc eon num er A 9702 1 1 /Q10

e nuc eus eca s emitting a roton it s ee to orm a ne nuc eus it s ee u e ne nuc eus an t e roton mo e a a rom one anot er in o osite irections

ic e uation gi es in terms o A an u

A $\frac{A}{4}$ 1 u

B A 1 u

C Au

D A 1 u

97 A strong in o s ee ms^{1} o s against a a e ensit o t e air is 1 2 gm e a as an area o 12 m^{2} at rig t ang es to t e in e ocit e air as its s ee re uce to ero en it its t e a 9702 12 1 /Q9

at is t e a ro imate orce e erte t e air on t e a

A 0 B 400 C 480 D 1 000

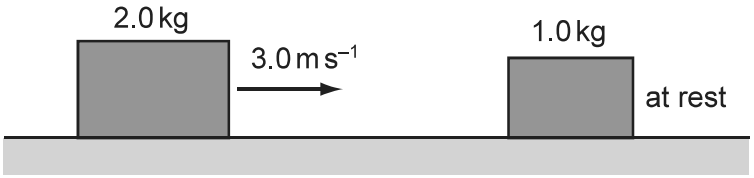
98 o s eres tra e a ong t e same ine it e ocities u_1 an u_2 e co i e an a ter co ision t eir e ocities are $_1$ an $_2$ 9702 1 1 /Q11

ic co ision is not e astic

	u_1 ms^{1}	u_2 ms^{1}	$_1$ ms^{1}	$_2$ ms^{1}
A	2			2
B			0	
C		2	1	
D		2		

99 A 2 0 g mass tra e ing at 0 m s ^{1} on a riction ess sur ace co i es ea on it a stationar 1 0 g mass e masses stic toget er on im act

9702 11 1 /Q11



o muc inetic energ is ost on im act

A ero B 2 0 C 2 4 D 0

100 o o ies tra e ing in a straig t ine co i e in a er ect e astic co ision ic o t e o o ing statements must e correct

9702 12 1 /Q10

A e initia s ee o one o i e t e same as t e ina s ee o t e ot er o

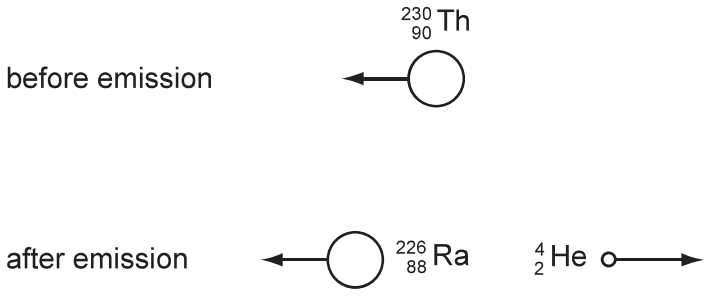
B e re ati e s ee o a roac et een t e t o o ies e ua s t eir re ati e s ee o se aration

C e tota momentum is conser e ut t e tota inetic energ i e re uce

D ne o t e o ies i e stationar at one instant

101 A mo ing t orium nuc eus $^{2\,0}_{90}$ s ontaneous emits an α artic e e nuc eus orme is a ra ium nuc eus $^{22}_{88}$ a as s o n

9702 1 1 /Q10



ic statement is correct

A e inetic energ o t e α artic e e ua s t e inetic energ o t e ra ium nuc eus

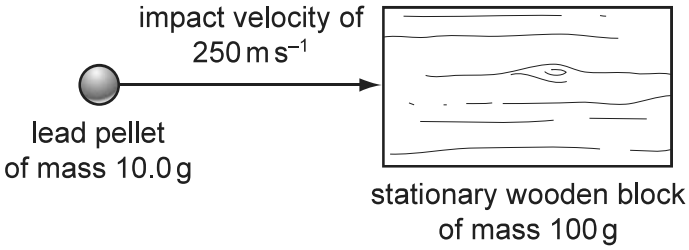
B e momentum o t e α artic e e ua s t e momentum o t e ra ium nuc eus

C e tota momentum e ore t e emission e ua s t e tota momentum a ter t e emission

D e e ocit o t e α artic e e ua s t e e ocit o t e ra ium nuc eus

102 A ea e et o mass 10 0 g is s ot ori onta into a stationar oo en oc o mass 100 g e e et its t e oc it an im act e ocit o 2 0 ms 1 t em e s itse in t e oc an it oes not emerge

9702 1 1 /Q13



at i e t e s ee o t e oc imme iate a ter t e e et is em e e

A 2 ms 1 B 2 ms 1 C 7 ms 1 D 79 ms 1

103 A eam o α artic es co i es it a ea s eet ac α artic e in t e eam as a mass o 10 27 g an a s ee o 1 10 7 ms 1

9702 11 1 /Q11

0 10 4 α artic es er secon co i e it an area o 1 0 cm 2 o ea A most a o t e α artic es are a sor e t e ea so t att e a e ero s ee a ter co ision

at is an estimate o t e a erage ressure e erte on t e ea t e α artic es

A 0 10 1 a

B 0 10 1 a

C 0 10 11 a

D 0 10 9 a

104 An iso ate s stem consists o t o o ies on ic no e terna orces act e t o o ies co i e it eac ot er an stic toget er on im act

9702 1 1 /Q11

ic ro correct com ares t e tota inetic energ an t e tota momentum o t e o ies e ore an a ter t e co ision

	tota inetic energ e ore an a ter t e co ision	tota momentum e ore an a ter t e co ision
A	i erent	i erent
B	i erent	t e same
C	t e same	i erent
D	t e same	t e same

105 An o ect o mass 4 0 g mo ing it a s ee o 0 m s [1] stri es a stationar o ect in an ine astic co ision

9702 11 14/Q9

ic statement is correct

A A ter co ision t e tota inetic energ is 18

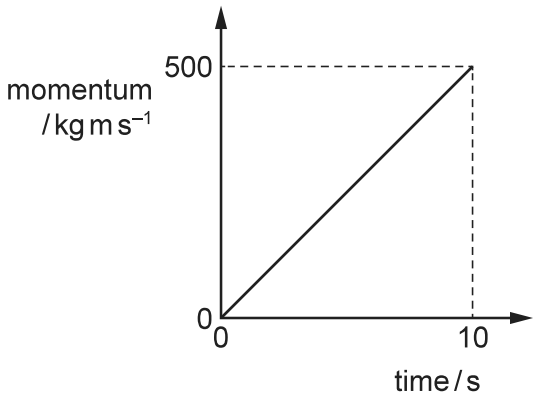
B A ter co ision t e tota inetic energ is ess t an 18

C Be ore co ision t e tota inetic energ is 12

D Be ore co ision t e tota inetic energ is ess t an 12

106 e gra s o s o t e momentum o a motorc c e c anges it time

9702 11 14/Q10

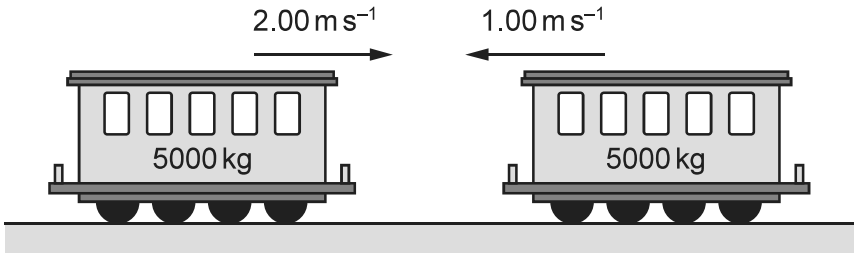


at is t e resu tant orce on t e motorc c e

A 0 B 00 C 2 00 D 000

107 o train carriages eac o mass 000 g ro to ar one anot er on a e e trac ne is tra e ing at 2 00 m s [1] an t e ot er at 1 00 m s [1] as s o n

9702 12 14/Q7



e co i e an oin toget er

at is t e inetic energ ost uring t e co ision

A 12 0 B 7 00 C 112 0 D 12 00

108 **A resu tant orce causes a o to acce erate** **9702 12 14/Q8**

at is e ua to t e resu tant orce

A t e acce eration o t e o er unit mass

B t e c ange in inetic energ o t e o er unit time

C t e c ange in momentum o t e o er unit time

D t e c ange in e ocit o t e o er unit time

109 **A s i o mass 8 4 10^7 g is a roac ing a ar our it s ee 1 4 ms^{-1} B using re erse t rust it can maintain a constant tota sto ing orce o 920 000** **9702 12 14/Q9**

o ong i it ta e to sto

A 1 secon s

B 1 0 secon s

C 2 minutes

D 2 0 minutes

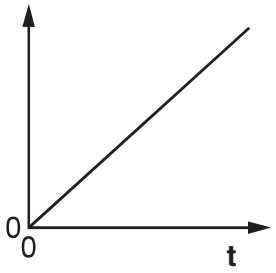
110 **A tractor o mass 1000 g is connecte a to ar to a trai er o mass 1000 g e tota resistance to motion as a constant a ue o 4000 ne uarter o t is resistance acts on t e trai er** **9702 12 14/Q10**

en t e tractor an trai er are mo ing a ong ori onta groun at a constant s ee o ms^{-1} at is t e orce e erte on t e tractor t e to ar

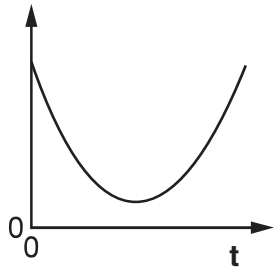
A 0 B 1000 C 000 D 4000

111 **A tennis a is ro e onto a ta e an ounces ac u e ta e e erts a orce on t e a ic gra est s o s t e ariation it time t o t e orce i e t e a is in contact it t e ta e** **9702 1 14/Q10**

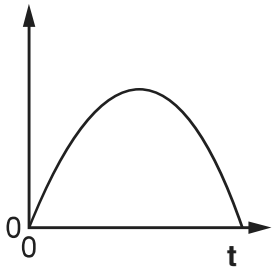
A



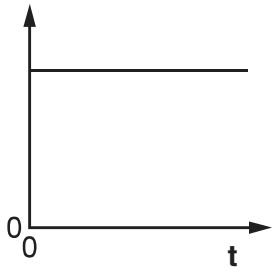
B



C

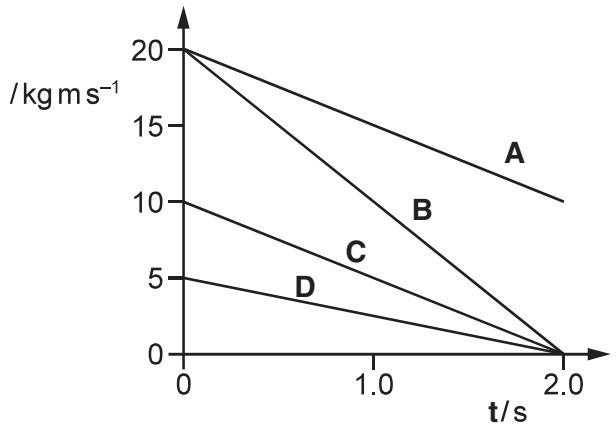


D



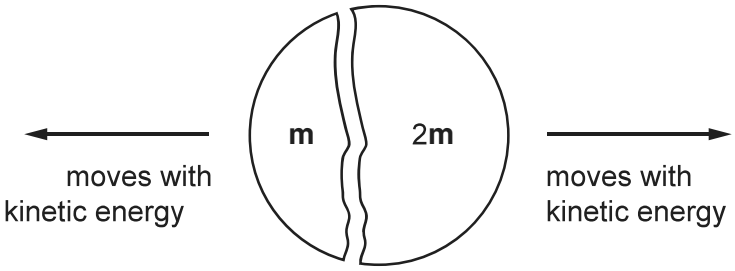
112 A resu tant orce o 10 acts on a o or a time o 2 0s 9702 1 14/Q11

ic gra cou s o t e ariation it time t o t e momentum o t e o



113 A stationar o e o es into t o com onents o masses m an 2m 9702 1 14/Q12

e com onents gain inetic energies an res ecti e

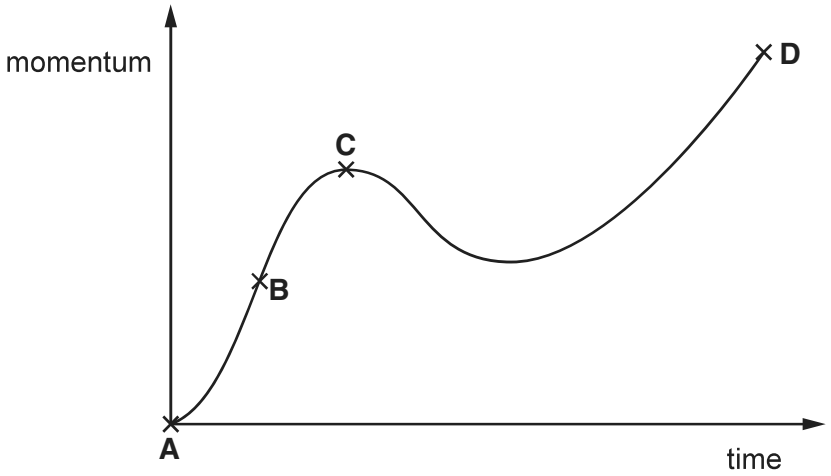


at is t e a ue o t e ratio —

A $\frac{1}{4}$ B $\frac{1}{2}$ C $\frac{2}{1}$ D $\frac{4}{1}$

114 A o e eriences a ar ing resu tant orce t at causes its momentum to ar as s o n in t e gra 9702 1 14/Q10

At ic oint oes t e resu tant orce a e t e argest a ue



115 A go a o mass m is ro e onto a ar sur ace rom a eig t $_1$ an re oun s to a eig t $_2$ 9702 1 14/Q11

e momentum o t e go a ust as it reac es t e sur ace is i erent rom its momentum ust as it ea es t e sur ace

at is t e tota c ange in t e momentum o t e go a et een t ese t o instants gnore air resistance

A $m\sqrt{2g_1}$ $m\sqrt{2g_2}$

B $m\sqrt{2g_1}$ $m\sqrt{2g_2}$

C $m\sqrt{2g_1 \quad 2}$

D $m\sqrt{2g_1 \quad 2}$

116 e iagram s o s a artic e it inetic energ a out to co i e it a stationar artic e Bot artic es a e t e same mass 9702 1 14/Q16

A ter co i ing an tra e on ar s toget er as a sing e arger artic e

o muc inetic energ is ost in t e co ision

A 0 B $\frac{}{4}$ C $\frac{}{2}$ D $\frac{}{4}$

117 o rai a truc s o masses m an m mo e to ar s eac ot er in o osite irections it s ee s 2 an res ecti e ese truc s co i e an stic toget er 9702 11 14/Q9

at is t e s ee o t e truc s a ter t e co ision

A $\frac{}{4}$ B $\frac{}{2}$ C D $\frac{}{4}$

118 at is t e rinci e o conser ation o momentum 9702 11 14/Q7

A orce is e ua to t e rate o c ange o momentum

B omentum is t e ro uct o mass an e ocit

C e tota momentum o a s stem remains constant ro i e no e terna orce acts on it

D e tota momentum o t o o ies a ter co ision is e ua to t eir tota momentum e ore co ision

119 ater is um e t roug a ose i e at a rate o 90 g er minute t emerges rom t e ose i e ori onta it a s ee o 20 m s [1]

9702 11 14/Q8

ic orce is re uire rom a erson o ing t e ose i e to re ent it mo ing ac ar s

A 0 B 270 C 1800 D 10 800

120 ic o t e o o ing is a statement o t e rinci e o conser ation o momentum

9702 1 1 /Q10

A omentum is t e ro uct o mass an e ocit

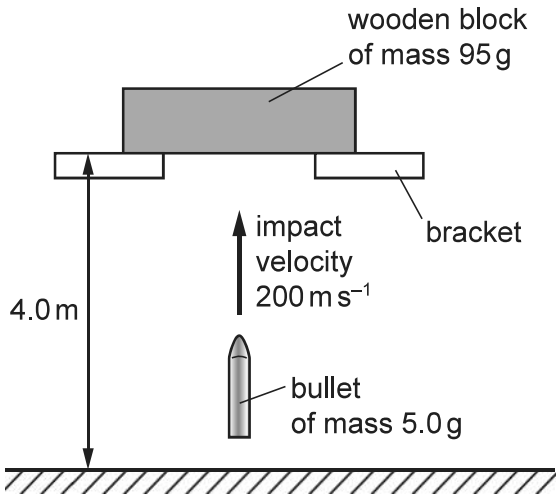
B n an e astic co ision momentum is constant

C e momentum o an iso ate s stem is constant

D e orce acting on a o is ro ortiona to its rate o c ange o momentum

121 A oo en oc is ree su orte on rac ets at a eig t o 4 0 m a o e t e groun as s o n

9702 1 1 /Q13



A u et o mass 0 g is s ot ertica u ar s into t e oo en oc o mass 9 g t em e s itse in t e oc e im act causes t e oc to rise a o e its su orting rac ets

e u et its t e oc it a e ocit o 200 m s [1] o ar a o e t e groun i t e oc e at t e ma imum eig t o its at

A 1 m B m C 9 1 m D 9 m

122 A mo ing o ect stri es a stationar o ect e co ision is ine astic e o ects mo e o toget er

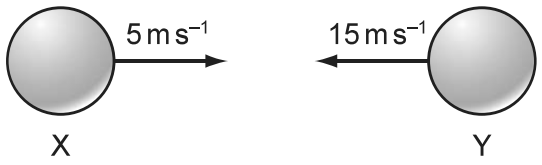
9702 1 1 /Q11

ic ro s o s t e ossi e a ues o tota momentum an tota inetic energ or t e s stem e ore an a ter t e co ision

	tota momentum e ore co ision gms ^{1}	tota momentum a ter co ision gms ^{1}	tota inetic energ e ore co ision	tota inetic energ a ter co ision
A		2	90	0
B			0	90
C			90	0
D			90	90

123 o a s an are mo ing to ar s eac ot er it s ee s o ms ^{1} an 1 ms ^{1} res ecti e

9702 1 1 /Q12



e ma e a er ect e astic ea on co ision an a mo es to t e rig t it a s ee o 7ms ^{1}

at is t e s ee an irection o a a ter t e co ision

A ms ^{1} to t e e t

B 1 ms ^{1} to t e e t

C ms ^{1} to t e rig t

D 1 ms ^{1} to t e rig t

124 A ire or roc et is ire ertica u ar s e ue urns an ro uces a constant u ar s orce on t e roc et A ter secon s t ere is no ue e t Air resistance is neg igi e

9702 12 1 /Q10

at is t e acce eration e ore an a ter secon s

	e ore secon s	a ter secon s
A	constant	constant
B	constant	ero
C	increasing	constant
D	increasing	ero

125 ro e mo ing a ong a ori onta riction ess trac co i es it a stationar tro e e t o tro e s ecome attac e an mo e o toget er

9702 12 1 /Q11

ic statement a out t is interaction is correct

A ome o t e inetic energ o tro e is c ange to momentum in t e co ision

B ome o t e momentum o tro e is c ange to inetic energ in t e co ision

C ro e oses some o its momentum as eat in t e co ision

D ro e s ares its momentum it tro e ut some o its inetic energ is ost

126 at is a reasona e estimate o t e a erage gra itationa orce acting on a u gro n oman stan ing on t e art

9702 11 1 /Q10

A 0 B 2 0 C 0 D 0

127 A mo ecu e o mass m tra e ing at s ee its a a in a irection er en icu ar to t e a e co ision is e astic

9702 11 1 /Q11

at are t e c anges in t e momentum an in t e inetic energ o t e mo ecu e cause t e co ision

	c ange in momentum	c ange in inetic energ
A	0	0
B	0	m^2
C	2m	0
D	m^2	0

128 at is t e e inition o t e orce on a o

9702 11 1 /Q14

A t e mass o t e o mu ti ie its acce eration

B t e o er in ut to t e o i i e its e ocit

C t e rate o c ange o momentum o t e o

D t e or one on t e o i i e its is acement