	Capacity (Ah)	Peak discharge (A)	C-Rate	Capacity × C-Rate = I discharge
A	62	59	0.60 C	37.2
B	63	58	0.68 C	42.84
C	61	56	0.67 C	40.87
D	65	59	0.62 C	40.3
E	67	57	0.65 C	43.55.

CHARGER

48 V, 40 A

RUN TIME

2 hours.

Voltage Requirement = 48V.

$I_{MOTOR\ AVG} = 30\ A$

$I_{MOTOR\ PEAK} = 47\ A.$

Efficiency (η) = 0.82

$P_{ELECTRONICS} = 150\ W$

$\Rightarrow I_{ELECTRONICS} = \frac{150}{48} = 3.125\ A$

Assuming Rise in vehicle weight only affects $I_{MOTOR\ AVG}$.

$I_{MOTOR\ AVG}$ when weight is high $= 30 \times 1.15 = 34.5\ A$

Now, We will find out what specifications we need for the battery.

(1) C-Rate.

$I_{Battery\ discharge} = (C\text{-Rate}) \times (\text{Capacity of Battery})$

We need.

$\eta \left(I_{Battery\ discharge}\right) \geq \left(I_{motor\ AVG}\right)_{high\ weight} + I_{ELECTRONICS}$

$\eta \rightarrow$ efficiency = 0.82

$\Rightarrow I_{Battery\ discharge} \geq \left(\frac{1}{0.82}\right)(34.5 + 3.125)$

$\geq 45.884\ A$

No single Battery can match this.
Thus we need atleast 2 in parallel

(2) Capacity.
We need,
(Battery capacity) $\geq \left((34.5 + 3.125) \frac{1}{0.82} A\right) \times (24)$
↓ Runtime.

≥ 91.768 Ah.

Again, No single battery can match this.
Thus, we need atleast 2 in parallel.

(3) Peak discharge.
47 A for motors
2.125 A for other electronics.

Battery Peak discharge $\geq (47 + 3.125) \frac{1}{0.82}$

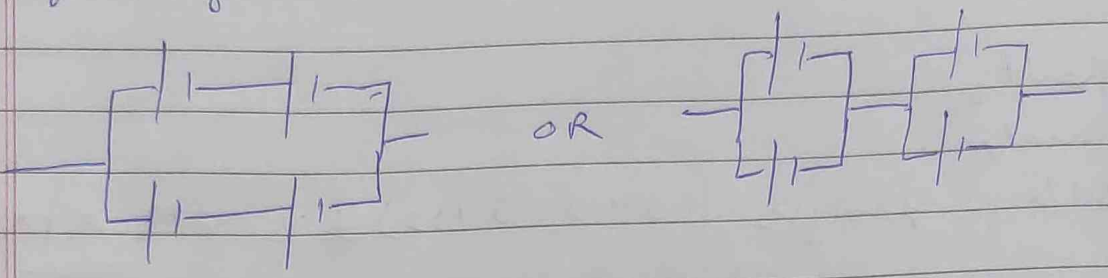
≥ 61.128 A

Again, we will need atleast 2 batteries in parallel.

[Factor (2) is the major factor here, Discharge and Peak discharge are still quite near to what can be achieved by a single Battery. But, for safety we shouldn't do this]

(4) Voltage Requirement
48 V ⇒ we will need exactly 2 Batteries in Series to achieve this (2 × 24 V)

From above constraints we can make the following circuit.



(Both are equivalent if the 4 batteries are the same)

Consider Voltage of one battery = x

Current of one battery = y.

This system will have

Voltage 2x and Current 2y.

Capacity will also be doubled.

⇒ CHARGING

For this configuration when charging each battery will charge at 24V, 20A

20A is much less than their maximum charging rates.

(considering C-rate also tells us the charging rate)

⇒ Every combination will require $\frac{[\text{Total capacity (in Ah)}]}{40A}$ hrs to charge fully.

⇒ However, considering the use case of 2 hours each combination will require. $\frac{91.768 (Ah)}{40 (A)} \simeq \boxed{2.29 \text{ hours}}$

[As we will only 91.768 Ah capacity in 2 hours]

Thus in this combination, we can choose any battery A - E as we ~~as~~ ~~as~~ quite justifiably satisfy ~~each~~ each constraint.

~~Considering this, we can arbitrarily choose any A.~~

~~Hence~~ Thus, for example, we could choose option E to maximise the capacity in the case of an emergency wherein the vehicle is unable to charge.

First Answer :—